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The **European Centre for the Development of Vocational Training** (Cedefop) is the European Union's reference centre for vocational education and training. We provide information on and analyses of vocational education and training systems, policies, research and practice.
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Foreword

The report confirms the importance of training for EU industrial policy. It demonstrates that sectors where training is firmly integrated in human resource practices have higher productivity gains. Such economic benefits are not only realised through developing workers' skills, but also thanks to higher job satisfaction and increased individual commitment to the organisation.

This report also contains evidence of spillover effects among workplaces within a sector in industrial clusters. These clusters usually develop around high value-added activities, which require firms to attract and retain a highly qualified workforce. To do so, firms have to adopt advanced human resource practices. They also have to cooperate and pool resources to satisfy skills development needs, whenever individual firms are not be able to sustain the necessary high training level. It appears that such joint training efforts decreases the negative impact and likelihood of losing trained workers to other firms.

The case studies collected in this report also show that public investment in training - catering the specific needs of these high value-added firms – can be very effective in inducing firms and stakeholders to work together, generating high spillover effects across entire industrial clusters.

The evidence collected here by Cedefop argues for integrating VET in regional and sectoral growth strategies. VET institutions may then act as a catalyst for the further development of industrial clusters. Smart growth in Europe would directly benefit from such integrated economic policies.

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Acting Director

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Executive summary

The study

The aim of the study is to look at the relationship between social benefits and the provision of training at sectoral level. The principal hypothesis is that social benefits (measured in terms of job satisfaction levels) are improved, other things being equal, by the provision of training and other learning opportunities, but there are sectoral specificities such that the relationship between job satisfaction and training varies significantly across sectors.

The sectoral specificities may relate to factors such as working practices in the sector, the principal forms of technology deployed in the production process, and social and cultural norms. These may all affect the relationship between worker and employer in any given sector, which has implications for the relationship between job satisfaction and training.

Job satisfaction and training: quantitative results

Research literature sees a central role for job satisfaction (however measured) in mediating productivity-enhancing behaviour. In general, where people are more satisfied with their jobs, they are more motivated, which has the potential to increase productivity by reducing employer costs (e.g. lowering recruitment costs through improved labour retention) and increasing output (e.g. by workers putting in more effort).

There is potential for both worker and employers to benefit: the former, through greater satisfaction from their employment and potentially higher wages, and the latter through improved organisational performance. In some sectors this may be more evident than in others.

Training is seen as one the factors — in the form of a gift exchange between employers and their workers — supporting improvement in job satisfaction. It is an essential part of the bundle of human resource measures necessary to improve levels of job satisfaction (and job quality more generally) necessary to bring about improvements in organisational performance.

The results show a positive relationship between job satisfaction and training (job satisfaction increasing with the length of the training) also when the effect of wage is controlled for. In this sense, the effect of training on job satisfaction can be likened to a gift from the employer.

There are also strong residual sector effects on job satisfaction, not accounted for by the explanatory variables and above those generated by training. Particularly strong positive effects on job satisfaction are found in financial intermediation (linked to relatively high levels of value added and high levels of skill in the workforce), manufacture of transport equipment (linked to improvements in working times and working hours), and electricity, gas and water and mining and quarrying (linked to relatively high levels of health and safety regulation). These are also sectors which employ many people either directly or indirectly, or are economically or strategically important to the economy of the European Union.

The results also reveal that training has an impact on job satisfaction when accompanied by a bundle of human resource practices: the effect of training on job satisfaction is strongest in the group of sectors characterised by a high incidence of high performance work places. Again, the sectors are those with relatively high skill levels (manufacturing of electrical machinery); value-added; and health and safety regulations (electricity, gas, water supply, construction, and manufacture of coke, refined petroleum, chemicals, plastics). The public sector is also included here.

For most sectors there is a positive and significant coefficient attached to the impact of training on job satisfaction. Overall the results suggest that job satisfaction within sectors can be improved at the margin by increasing the volume of training, alongside other factors which are also related to job satisfaction. Training episodes of short durations are associated with low job satisfaction, but the actual average volume of training (i.e. the number of training days) in the sectors is large enough so that the effect on job satisfaction is mostly positive.

However, for a few sectors, training episodes tend to be of short duration and are associated with low job satisfaction. In these cases, the volume of training required to transform the impact on job satisfaction into a positive one is often too large to suggest that such a transformation is possible.

Job satisfaction, training and productivity: quantitative results

The impact of employer-provided training on productivity growth was positive and highly significant; higher levels of training are linked to higher labour productivity growth.

Strong residual sector effects on productivity growth are also found. The sectors with particularly strong growth rates included water and air transport, financial intermediation, education, and public administration.

If the volume of training provision is enough to generate positive job satisfaction — a gift to employees — the question of whether this gift is returned to employers in the form of higher productivity has not been addressed yet. To do this, job satisfaction and productivity growth regressions have been estimated for each sector separately. The sectors have been ranked twice, first on the basis of the size of the impact of training on job satisfaction (resulting from the job satisfaction regression) and second on the impact of training on productivity growth (resulting from the productivity growth regression). Positive correlation was found between the ranking of sectors in terms of the contribution of employer-provided training to job satisfaction and the ranking in terms of the impact of training on productivity growth. This positive correlation can be regarded as tentative evidence, suggesting that training may be the subject of some form of 'gift exchange' between employers and employees: by providing a sufficient volume of training the former make a gift of increased job satisfaction to the latter, a gift that is reciprocated by workers with higher productivity growth.

Job satisfaction, training and productivity: case study findings

Five sector studies in specific geographic clusters (or networks of producers) were undertaken: medical technologies; textiles; advanced engineering; finance; and renewable energy. The case studies revealed that:

(a) the supply of highly skilled labour — from within internal and external labour markets — is a critically important factor in the growth and competiveness of each of the clusters;

(b) public agencies and private firms are engaged in the supply of knowledge which firms within the networks require for the networks to flourish;

(c) training investments are pivotal in the restructuring each of the clusters has gone through. Human capital investments are not restricted to supporting the expansion of growth industries. In declining industries, such as textiles or shipbuilding, available skills are adapted and transformed into new occupations to establish the knowledge base for more productive activities;

(d) the high degree of innovation observed in all the cases studies would not have been achievable without the long-term accumulation of professional knowledge in local labour markets;

(e) there is a high degree of cooperation among companies within networks, which aids sharing of knowledge for the benefit, in the first instance, of the production process;
(f) production structures are heavily influenced by the provision of skills in local labour markets. Skill provision allows for the development of high-value production allied to relatively good working conditions.

The commitment from firms to train is essentially driven by the commitment to obtain and sustain relatively high value-added positions in the market. A further feature is the need to create a stable working environment to retain people within a particular firm or network of firms. If there is a high degree of labour turnover, coupled to skill shortages, the nature of the social contract within the network tends to break down: employers seek to retain their own staff and prevent them, as far as possible, from leaving to join other companies. This will negatively affect cooperative working among companies. Therefore companies need to develop human resource policies, alongside the continuing supply of training, to retain people, if not within a particular firm, then at least within the network of firms.

In the case study analysis — though not necessarily in the quantitative analysis which shows that the gift exchange is limited to role of training in the exchange — there is indicative evidence of a three-way gift exchange among employers, workers and the State: employers provide training as part of an overall bundle of human resource practices designed to attract and retain workers within the firm or network; workers benefit through the accumulation of human capital and good working conditions which is reciprocated in generating relatively high levels of value-added; the State provides infrastructure for the development of knowledge and the sharing of ideas and obtains a public return depending upon the success of the clusters or networks it supports.

Conclusions

The study indicates the way in which a gift exchange operates with respect to the provision of training by employers and the impact this has on working conditions within sectors. The evidence points to a win-win for both employers and workers within certain sectors. Training is also seen as an important element in raising productivity levels.

The evidence is positive with respect to training being part of an overall bundle of human resource practices associated with relatively high levels of job satisfaction. In those sectors where workers expect to be in receipt of training on a regular basis, lack of access to training becomes a source of dissatisfaction.

The more qualitative work suggests that the development of human capital is central to networks of companies within sectors able to develop high value-added product market strategies. Good working conditions are seen as a necessary element of the overall bundle of human resource practices which ensures that any investments in human capital are retained with a firm or network of firms. The State is also seen as an important catalyst in developing networks of highly productive firms within a sector, an industrial cluster, and providing a training infrastructure. Industrial clusters are environments in which the social benefits from training would tend to materialise naturally because they are centred around high productivity activities requiring continuous upskilling (training) and where firms must deploy highly developed human resource practices to be able to attract and retain a highly qualified workforce. The positive impact that these have on productivity levels will, in turn, contribute to the success of the cluster. Industrial clusters are dynamic in nature, so they tend to grow and to attract new firms that will have to comply with the prevailing standards of training provision and human resource practices; hence they play a key role in spreading the conditions under which the benefits of training are more likely to spill over to other firms in the sector.

CHAPTER 1.

Introduction

Economists, statisticians and psychologists are increasingly concerned with understanding whether growth in the economy is being translated into a corresponding level of social progress.

The social, or wider benefits, for the employee relate to the quality of their work and can be measured in terms of job satisfaction levels. Job satisfaction is a multi-dimensional concept relating to different aspects of workers' jobs including the intrinsic level of interest they obtain from it, their perception of fairness in the workplace, and levels of autonomy and responsibility. This is not just about non-monetary benefits since wage levels, and the extent to which they are considered fair, are likely to be related to perceptions of job quality. The present study controls for earnings, although its main focus is on the effects of non-pecuniary aspects of working conditions on job satisfaction and, within this, the particular role played by training and other dimensions of skill development.

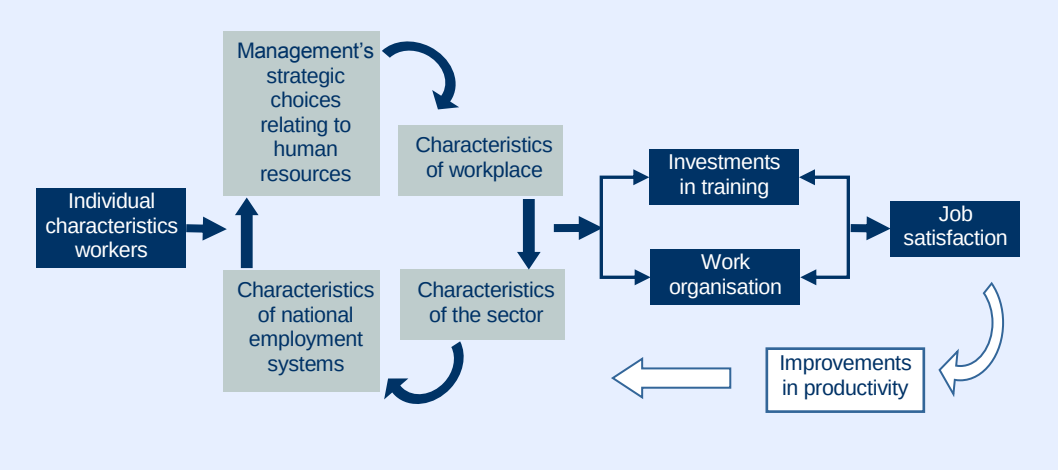
The aim of this report is to look at the social benefits of training from a sectoral perspective. The principal hypothesis is that job satisfaction is improved, other things being equal, by the provision of training and other learning opportunities, but that the relationship between job satisfaction and training varies significantly across sectors. The general model is set out in Figure 1. This sees the sectoral dimension as one factor among others which is likely to affect training and job satisfaction.

The individual (sociodemographic and educational) characteristics of employees are likely partly to determine their job satisfaction, which will be further influenced by conditions in the workplace, the strategic choices made by management in specific workplaces, and sectoral conditions or norms. The impact on job satisfaction is then mediated through working conditions and access to vocational education and training (VET). Levels of job satisfaction, potentially, influence productivity levels which feedback to affect workplace and sectoral conditions.

Many studies have looked at how job quality is linked to job satisfaction (for the employee) and improved productivity (for the employer). These studies will be referred to at various points throughout the present report. They are important because the present work adopts a 'gift exchange' framework in which employers might offer improvements in working conditions (e.g. the introduction or extension of employer funded training) if employees respond by offering greater motivation

and commitment which leads to higher labour productivity. The 'gift exchange' framework is developed in Chapter 3.

Figure 1 **Conceptualisation of the relationship between training and job satisfaction at sectoral level**



Sectoral effects occur in various ways. They might occur when certain technologies used in one sector are less prevalent in others; different sectors have different histories, cultures, and forms of collective agreement. The effects of such factors are difficult to deal with in terms of econometric modelling; often they appear, bound together in the form of some residual sector specific effects (e.g. the 'residual sector dummy variable' effects) (Chapter 4). This group of effects is better dealt with through qualitative analysis.

There is a second group of effects that are more amenable to econometric study. These deal with the choices organisations within each sector make about various aspects of their working conditions, such as training and work organisation (Figure 1). That is not to say that organisations in a particular sector can freely choose any level or form of training or work organisation (there may be limits set by cost-effectiveness or by sector specific influences of the type discussed in the previous paragraph), but those where certain practices are more prevalent may give rise to greater social benefits than those where they are less prevalent.

This second group of sectoral effects is an area more suited to econometric analysis of the type used in Chapters 4 and 5. In Chapter 4, in particular, an attempt is made to explore key results (e.g. the effects of training on job satisfaction) by estimating separate results for each sector. Despite lack of robustness in these results, it is possible to demonstrate a largely common

pattern across sectors in the relationship between training and job satisfaction, but a relationship that also differs across sectors. In addition, key estimates taken from the overall results (e.g. where all sectors are included in the model) are reported at sectoral level ([1]).

What does the research hope to find from the econometric analysis?

(a) Is there empirical support for the conceptual model summarised in Figure 1 — put crudely, do working conditions drive job satisfaction and does job satisfaction drive productivity performance, other things being equal — or is the relationship more complex?

(b) If the relationship is more complex, then are there particular dimensions of working conditions that are consistent with both higher job satisfaction and improved productivity (where their introduction would suit both managers and workers) and other dimensions that suit only one party, which might be a point of conflict?

(c) Is it possible to say how training and other forms of skill development impact differently on job satisfaction across sectors?

(d) In the light of the econometric results on the importance of different dimensions of working conditions, which are the sectors which offer levels of key dimensions of working conditions that give rise to the greatest satisfaction?

From a quantitative perspective two sets of data are of considerable importance to the study:

(a) European working conditions survey (EWCS, 1999/2005) ([2]);

(b) continuing vocational training survey (CVTS, 1999/2005) ([3]).

The methodological approach has adopted a four-stage strategy:

(a) definition of the independent variable(s): EWCS asks directly about job satisfaction but there are also other variables which ask indirectly about job satisfaction (e.g. whether the job is hazardous or monotonous, etc.) where

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([1]) This is done by taking the coefficient estimates for the key variables (e.g. the estimate of the effect of a small change in that variable on job satisfaction and multiplying them by the mean values of that variable for each sector.

([2]) EWCS 2005 is a survey of individual employees (29 680 respondents) in the 27 Member States plus Norway, Switzerland and Turkey, which covers all economic sectors. It provides the core data on individuals' reported levels of job satisfaction and levels of training accessed.

([3]) CVTS 2005 provides information on training level, training plans, and training costs at sectoral level (data for all 27 Member States and Norway but excludes agriculture and the public sector [i.e. NACE Rev 1.1 sectors A, B, M, N, and O]). In addition, KLEMS data provides data on sectoral productivity levels.

the latter can form dependent or explanatory variables depending on the context in which they are used;

(b) econometric analysis of micro data — mainly based on EWCS — with sectoral level data drawn from the other surveys added to the data set, where the results are synthesised at sectoral level;

(c) through a series of sector studies, concentrated in specific geographic locations so that networks and clustering among firms can be observed: explanations are provided for the extent of sectoral variation either across the EU or within particular countries with respect to the level of training;

(d) a synthesis of the quantitative and qualitative evidence to provide recommendations about sectoral level policies can drive up both levels of human capital and job satisfaction, which then, potentially, feed through into productivity improvements.

This report is structured as follows. Chapter 2 provides information about measuring job quality and the role of training and skills in the most commonly used classifications. Information is also provided on how the relationship between job quality and training and skills might be affected by sectoral level considerations. Chapter 3 summaries the theoretical perspective developed in *The anatomy of the wider benefits of VET in the workplace* (Cedefop, 2011) which forms the basis for work undertaken at sectoral level. Chapter 4 gives econometric results detailing how the various dimensions of job quality varies by sector across the EU and looks specifically at the role played by training and other forms of skills development in bringing about improvement in the quality of work. Chapter 5 looks at the relationship between the quality of work and productivity. Chapter 6 provides a series of sector studies which explain how sectoral differences affect the relationship between job quality and education and training. Chapter 7 concludes and highlights policy implications.

CHAPTER 2.

The quality of working life, education and training: sectoral influences

2.1. Introduction

Educational attainment and access to lifelong learning are seen as important elements in the overall mix of what constitutes good quality employment. They are included, for example, in the Laeken indicators of job quality constructed by the European Commission (European Commission, 2003). Empirical evidence generally points to prior educational attainment being one of the main determinants of who gains access to relatively well-paid, secure employment which, in turn, offers access to further learning and skills development which, other things being equal, reinforces the labour market standing of the individual (OECD, 2009). In this report, the interest is in the extent to which factors at sectoral level affect the quality of work in several ways: the mimetic behaviour of employers in any given sector; the dominance of a given technology used in the production of goods or services; the role of intra- or inter-sectoral supply chain relationships; and the influence exerted by labour market institutions. Before considering these issues in detail, consideration is given to measuring job quality and the position of education and training in commonly used measures.

Possibly as a result of rising real incomes across the EU during the 2000s, attention has increasingly been focused on both the quality of life (c.f. Stiglitz et al., 2009) and on the quality of working life (c.f. the European Commission's 2020 agenda). But public policy interest can be fickle. The evidence suggests that the quality of working life might be of interest when conditions in the economy are buoyant; when employment is in decline or growth is stagnant, policy is understandably much more focused on stimulating employment growth in general rather than relatively good quality jobs (European Commission, 2008). The aftermath of the 2008-09 economic crisis may yet have detrimental consequences for the quality of work across the EU. Nevertheless, improving the quality of working life, and the quality of life in general, remains an important goal, explored across the centuries by philosophers, economists and psychologists, and ultimately resilient enough to withstand the fortunes of the economic cycle.

This chapter begins with a review of the issues relating to measuring quality and satisfaction with life and jobs, before considering the sectoral issues in more detail.

2.2. The quality of working life

Quality of life measures or indicators used in the EU and OECD classifications follow the multi-dimensional approach (Box 1) from, at its highest level, the state of the physical environment (e.g. pollution levels) to micro-level indicators such as individual income.

Box 1 **Quality of life in Europe**

Measuring national well-being may be seen as a current vogue among statisticians and economists, but this would be to ignore the fundamental issues provoking interest:

(a) the inadequacy of GDP as an indicator of economic, let alone, social progress;
(b) the extent to which economic growth has conferred a range of social benefits on individuals;
(c) the value society ascribes to social goods.

Conceptually, the quality of life can be considered in several ways. The first is subjective well-being, which simply asks individuals to consider and rate for themselves either their overall satisfaction with their life or various elements of it. From a liberal perspective this recognises that individuals are best placed to evaluate their own situation. Other theoretical perspectives would point out that individuals may have imperfect information about their current position, either as a result of, for instance 'false consciousness', or a failure to recognise that their full potential is not being realised in some way (c.f. Lukes' theories on power). A second perspective suggests that individuals are capable of satisfying a range of higher order needs if only they had the chance to realise them. According to Maslow (1970) individuals have a hierarchy of needs to be satisfied from the most basic, such as physiological ones (e.g. food and sleep), to security (e.g. obtaining accommodation and an income) and those which allow for the development and expression of individuals' creative and intellectual interests. The inability to obtain lower order needs inhibits or prevents the realisation of the higher order ones. The third approach, identified in the Stiglitz report, is the idea of fair allocations: 'the basic idea, which is common to welfare economics, is that of weighting the various non-monetary dimensions of quality of life (beyond the goods and services that are traded in markets) in a way that respects people's preferences. This approach requires choosing a particular reference point for each of the various non-monetary dimensions, and obtaining information on people's current situations and on their preferences with respect to these points' (Stiglitz et al., 2009).

These ideas are increasingly being taken up by pan-national organisations and national statistical offices. The European Commission (2007), OECD (Hall et al., 2010), and national statistical offices across Europe (e.g. UK ONS, 2010), have all developed typologies or classifications to measure the quality of life. From a European perspective, the EU's sustainable development indicators, which include factors which represent its key objectives and policy concerns for the future, are of particular interest.

European Commission sustainable development indicators

Measure	Strategic need for measure
Socioeconomic development	Progress towards a prosperous, innovative, knowledge-rich, competitive and eco-efficient economy, which provides high living standards and full and high-quality employment throughout the EU
Sustainable consumption and production	Progress towards sustainable consumption and production patterns
Social inclusion	Progress towards a socially inclusive society by considering solidarity among and within generations and to secure and increase the quality of life of citizens as a precondition for lasting individual well-being
Demographic changes	Progress towards creating a socially inclusive society by considering solidarity between and within generations and to securing and increasing the quality of life of citizens as a precondition for lasting individual well-being
Public health	Indication of the extent to which good public health on equal conditions has been achieved and improvements towards protection against health threats
Climate change and energy	Progress towards limiting climate change and its costs and negative effects on society and the environment
Sustainable transport	Progress toward ensuring that EU transport systems meet society's economic, social and environmental needs while minimising their undesirable impacts on the economy, society and the environment
Natural resources	Improvements in the management and avoiding overexploitation of natural resources, recognising the value of ecosystem services
Global partnership	Progress towards promoting sustainable development actively worldwide and ensuring that EU internal and external policies are consistent with global sustainable development and its international commitments
Good governance	Progress towards promoting coherence among all EU policies and coherence among local, regional, national and global actions to enhance their contribution to sustainable development

Source: Derived from European Commission (2007).

The OECD approach similarly emphasises a set of final goals for society and intermediate goals which should be reached along the way if progress is to be achieved towards the final goals.

Final goals	Ecosystem condition: outcomes for the environment	land (geosphere) freshwater, oceans and seas (hydrosphere) biodiversity (biosphere) air (atmosphere)
	Human well-being: outcomes for people	physical and mental health knowledge and understanding work material well-being freedom and self-determination interpersonal relationships

Intermediate goals	Economy	national income
		national wealth
	Culture	cultural heritage
		arts and leisure
	Governance	human rights
		civic and political engagement
		security and violence
		trust
		access to services

Source: Derived from Hall et al. (2010).

The multi-dimensional or multi-level approach is germane to the study of job quality, especially subjective assessments of an individual's job quality, which may well be shaped by employment-related factors which lie beyond that workplace. The broad headings in either the EU or OECD classifications can be readily developed with respect to the quality of working life or conditions in the workplace.

The study of job quality has a long tradition and was summarised in a recent Cedefop report (Cedefop, 2011). Here the aim is summarising how job quality can be measured and applied at sectoral level to indicate patterns across the EU. The following broad dimensions are needed in the analysis of job quality:

(a) remuneration levels;
(b) job and income security;
(c) objective measures of job content;
(d) subjective attitudes of workers towards their work situation (including a sense of fairness or lack of discrimination in the workplace).

This is a basic classification but covers the main headings. The most comprehensive assessment of job quality has been undertaken by the European Commission in its development of a typology of job quality, usually referred to as the Laeken indicators of job quality (European Commission, 2003). The typology includes:

(a) intrinsic job quality;
(b) skills, lifelong learning and career development;
(c) gender equality;
(d) health and safety at work;
(e) flexibility and security at work;
(f) inclusion and access to the labour market;
(g) work organisation and work-life balance;
(h) social dialogue and worker involvement;
(i) diversity and non-discrimination;
(j) overall work performance.

The Laeken indicators are measures designed with respect to the macro or national level. There is also a need to consider how these types of indicator might be operationalised at sector level.

There is a tendency to see quality of work issues solely with respect to the subjective or objective position of the individual in the workplace, such as self-reporting of job satisfaction versus measures of the extent to which workers have a degree of autonomy in their jobs or the physical nature of the job. But factors beyond the workplace, such as prevailing conditions in the external marketplace, the dominant mode of production in the sector, and the individual's orientation towards work in general affect the quality of working life or the perception of it. The Laeken indicators partly recognise the need to introduce this dimension into any analysis of the workplace, but not comprehensively so.

The European Foundation's classification of job quality is based on four groups of indicators (Eurofound, 2002):

(a) career and employment security:
    (i) employment status;
    (ii) income;
    (iii) social protection;
    (iv) workers' rights;
(b) health and well-being:
    (i) risk exposure;
    (ii) work organisation;
    (iii) health problems;
(c) reconciliation of working and non-working life:
    (i) social infrastructures;
    (ii) working/non-working time;
(d) skills development:
    (i) qualifications;
    (ii) training;
    (iii) learning organisation;
    (iv) career development.

The European Foundation's classification of job quality has been criticised for lack of justification for the indicators (European Parliament, 2009), even though they are typically found in many of the other classifications reviewed by the European Parliament:

(a) the European job quality index of the European Trade Union Institute;
(b) the ILO's decent work index (Anker et al., 2003);
(c) the Canadian quality of employment indicators (Brisbois, 2003);
(d) DGB ([4]) good work index (Mußman, 2009).

([4]) Confederation of German Trade Unions.

The benefit of using the European Foundation's approach is that it is designed for use with the European working conditions surveys.

What is clear is the centrality of education and training to explaining the quality of working life. It offers entry to a virtuous circle whereby initial education and training gives access to relatively high quality employment, which incorporates career development allied to lifelong learning; this, in turn, increases the intrinsic and extrinsic work-related rewards available to an individual, in their existing job or by granting access to other jobs. How this operates at sectoral level is considered in more detail below.

2.3. Sectoral dimensions

Employee job satisfaction is related, other things being equal, to VET in the workplace (Cedefop, 2011). There are, however, several sectoral specific conditions which may positively or negatively affect this relationship:

(a) the dominant technology and the extent to which this permits a degree of strategic choice with respect to the organisation of work;
(b) the extent to which networks develop within sectors, in part due to supply chain relationships which can affect the link between education and training and work quality;
(c) the existence of statutory requirements at sectoral level which affects job quality and the need to provide training;
(d) the nature of the social contract at sectoral level;
(e) the ability of original equipment manufacturers (OEMs) to exert influence over working conditions throughout the supply chain.

Each of these is considered in turn below.

2.3.1. Job design, skill needs and training

While the debate about the relationship between job design and technology has moved on a long way since the technological determinism associated with work of researchers such as Woodward (1965) and Blauner (1964), or Braverman's theory of management purposefully de-skilling work to gain control over the production process (Braverman, 1974), there are features which are specific to certain sectors which need to be accounted for in any analysis. These relate to work practices which reflect the level of danger extant in some sectors, such as mining and quarrying or construction, and the principal technology or production in some sectors. It is also apparent that a given technology is often pervasive across a sector. An example of this is the newspaper printing industry where, over the late 1970s and early 1980s, the sector as a whole moved from hot metal

to flexographic printing linked to the digital input of data. Yet the evidence, even in sectors where there is a dominant form of technology, is that the employer has a degree of strategic choice concerning the organisation of work, the extent to which employees need to be skilled and have the capacity to exercise any judgment or responsibility in carrying out their job. A case study from the late 1980s revealed how management at a local newspaper group had deliberately designed the production system so that it was staffed by machine operatives, rather than skilled printers, so that management retained the technical knowledge of the production process and, thereby, the control of it (Hogarth, 1992). Management reported that other skill configurations on the production line were viable but decided, in the light of the prevailing industrial relations in the company and sector, effectively to de-skill the jobs on the production line by laying-off skilled printers and replacing them with machine operatives. Management, on the other hand, needed to be trained in the use of the new technologies. The case illustrates how factors at sectoral level interact with those at individual workplace level — in this case the state of industrial relations in the printing industry at the time — to bring about a particular configuration in job design and skill levels.

2.3.2. Inter-firm networks, skills and job content

The advantage of observing the relationship between job quality and skills from the sectoral level is that it recognises that employers do not exist in isolation. Typically employers exist within networks usually related to the supply of intermediate goods and services resulting from:

(a) industrial specialisation, where organisations concentrate on their core activities;
(b) subcontracting of non-core activities;
(c) geographical clustering of employers.

It is readily apparent that ICT has allowed much closer links to be developed among firms in a network, regardless of their proximity. It is increasingly apparent that networks make a virtue of this lack of proximity, with time differences allowing continuous operation on a 24-hour basis as teams pass their work onto teams in the next time-zone. It is also apparent that inter-organisational networks are not just concerned with the integration of production systems but also the transmission of knowledge and tacit knowledge about how systems or processes work (Cooney and Long, 2008). Human capital, therefore, can be accumulated on a shared basis. The case study by Brown et al. (2004) exemplifies this, discussing how an OEM in the aerospace sector developed a learning network to drive continuous improvement throughout its supply chain. This, in turn, provided opportunities for collaborative learning which could be transferred to individual

companies. As the network developed there was a move away from a focus on learning within particular organisations to that of shared learning across the network, as those involved were able to reflect collaboratively on their experiences. The gains from such collaborative learning are only capitalised upon if job designs across the network of companies allow new skills to be deployed effectively. Learning cannot take place in isolation.

Several studies are also beginning to reveal the extent to which area-based initiatives can help develop an economy, often using a cluster-based approach reflecting the success of this strategy in revitalising the Massachusetts economy in the early 1980s (c.f. the Boston life sciences Cluster) and the development of Silicone Valley from the 1950s onwards. While the origin of these clusters might have been in research and development (R&D), it is apparent that they have developed well beyond their initial focus to create high-skill ecosystems characterised by relatively well-paid, highly-skilled work where individuals are quite mobile among companies (Finegold, 1993). Proximity is of considerable importance in that the closer employers are to one another in a given sector, the greater the benefits from the common pool that they create (Griliches, 1992).

Clusters can be considered in learning networks — possibly through supply chains — where employers can learn from one another and begin to share some of the training costs. Inter-firm cooperation and clustering can help increase innovation and productivity levels within networks or clusters; businesses need to keep up with other employers, otherwise they might not be able to maintain their position in the network or cluster. If too many businesses are unable to keep pace, the network itself will fail. So there is a form of peer pressure which can support the provision of training as well as the network being able to reduce training costs. Training networks can develop around these business clusters, generating positive externalities at sectoral and local levels (Hogarth et al., 2009).

2.3.3. Sectoral regulation, skills and job content

Across the EU, businesses are subject to a range of sector-specific regulations which may vary further in different Member States. Regulations, or standards, have the capacity to affect the provision of training and job design on a sectoral basis. Evidence of this is rather thin, but evidence in relation to R&D and innovation reveals that it has increased productivity in the post-war period (Temple, 2005). It is assumed that the introduction of standards results in some form of learning taking place so that the standard might be applied; hence there is a potential spillover into training. In the UK, the principal standard in human resource management is Investors in People. The evidence in relation to the effect of IiP on training levels, though mixed, indicates that accreditation is

associated with increased levels of training (Rayton, 2007; Hoque and Bacon, 2008). What is not clear in the evidence is the scale of training which takes place as a consequence of statutory or non-statutory regulation governing the conduct of work in a sector and, further, what impact this then has on the quality of work.

2.3.4. Social contract and bargaining institutions

The extent to which employees enjoy a degree of social protection at sectoral level through collective bargaining or other forms of employment regulation can have an important bearing on worker attitudes to jobs (especially if using a subjective measure of job quality). Collective bargaining and other forms of employment regulation are likely to frame attitudes to job security, which is likely to be one of the principal determinants of individuals' attitudes to their jobs.

In some sectors, especially in services, trade unions and staff associations have struggled to establish certain rights. For example, in accountancy, professional accountants, and their employers, regarded access to continuing professional development, allied to relatively well structured career development paths, as a basic entitlement.

Collective bargaining can have an indirect effect on attitudes or perceptions of job quality. Issues of job security and remuneration may shape employee attitudes; for example, employees who find the content of their work intrinsically satisfying may still harbour negative attitudes to their employers if they have not received a pay increase. If these issues can be agreed through collective bargaining (at the workplace, sector, or national level) rather than individual bargaining (workers directly bargaining with their employer) then this removes one of the factors which might otherwise negatively influence attitudes to subjective job quality.

2.3.5. The influence of the OEMs

A final point relates to the dominance of the OEM in some sectors. Corporate social responsibility, a core value for many large corporations, can take various forms such as support for the arts or social philanthropy). A more mundane, though socially important aspect of corporate social responsibility, is the provision of VET through, for example, offering apprenticeships to young people, some of whom may be socially disadvantaged. This can be passed down the supply chain such that all main suppliers are expected to follow this commitment. The influence of the OEM is not restricted to corporate social responsibility and it is clear that many large employers expect their suppliers to have a complement of skilled people and to train to the standards expected of the OEM. This helps maintain quality standards (Binks, 2004).

The importance of the OEM driving training standards within a sector is that it raises the possibility of job quality being improved as a consequence of people being skilled to a higher level; there is a presumption that the costs of any training need to be recouped through higher levels of productivity which, in turn, is to be realised by more effective deployment of skills. Potentially this can be obtained by providing the individual employee with more responsibility and autonomy in meeting the needs of the business. It can, of course, result in the intensification of work.

2.4. Conclusion

Frameworks and typologies of job quality place education and, to a lesser extent, training, at the centre of affairs. Education and training are the keys which open the way to individuals obtaining better quality employment in the first place and then progression through the labour market. The way they affect job quality (and the overall quality of life) is complex. Individuals' capacity to realise any of the social benefits which might be expected from their initial educational attainment is constrained and facilitated at several levels. First, unless individuals have some ambition to obtain improved quality of working life, its achievement will be largely down to chance. At workplace level are the strategic choices made by employers regarding the value they place on the quality of work and continuing VET (CVET). At sectoral level is the extent to which sector-specific factors inhibit or support the realisation of social benefits by the employee with respect to the quality of their work and access to VET. Then there is the extent to which the economic environment is conducive to individuals being able to obtain improved working conditions and access to lifelong learning. Finally, there is also a need to consider the range of non-work related factors identified in the frameworks and typologies which deal with the overall quality of life, which may affect individuals' orientations to every aspect of their lives.

All of the above factors are inter-related and are likely to have a differential impact on the quality of working life: the quality of work is a multi-dimensional concept. The aim in this report is to explore the interrelationship among the manifold dimensions of job quality at sectoral level and, further, identify the relative importance of the education and training dimension.

CHAPTER 3.

The determinants and dimensions of job quality: theoretical considerations

3.1. Economics and beyond

The previous chapter addressed some of the measurement issues relating to job satisfaction and job quality, the role of training in the various typologies of job quality, and how these are likely to play out at sectoral level. The present chapter looks at these issues from the perspective of economic theory as a precursor to the empirical chapters which follow. The concept of social benefits adopted here is not the one normally used by economists, concerned with additional tax gains or spillover effects of training and other skill development activities. While these can be important, the focus of the present study is on the social benefits of improvements in working conditions, especially training and skill development, in terms of employee satisfaction and enterprise performance.

Mainstream economic models, such as human capital theory, focus on the direct pecuniary costs and benefits of training. In the simplest neoclassical framework individuals will only pay for their training if they benefit sufficiently in terms of their future flow of income; employers will only invest in training if they can justify it in terms of their future stream of profits. This leads to the dichotomous outcome of human capital theory: individuals benefit from 'general training' because it leads to skills that would be of use to a wide range of employers, hence individuals pay for it; employers benefit from 'specific training' because the skills are unique to that firm, hence employers pay for it ([5]).

The application of human capital theory to education, which is almost entirely 'general' in nature (e.g. of use to a wide range of employers) was an important step forward and led to considerable understanding of the economic benefits of education in terms of higher future earnings. With some important exceptions, however, little has been done to explore the social returns on education, other than the additional tax gains brought about by higher earnings of

([5]) The specific and general training framework is one where the employee seeks to maximise their benefit from employer-provided training, through the existing employer paying a higher wage or by moving from the present employer to one who will pay more. In this framework the employer seeks labour trained by other organisations, while keeping their own trained labour. In addition, the employer maximises the share of the benefits of their training that go to profit rather than in terms of higher wages of employees.

more educated individuals. While educational externalities have been recognised at least as far back as Marshall (1890) and such externalities have been reiterated in literature from time to time (Blaug, 1968) ([6]), empirical studies have been piecemeal ([7]).

It was implicitly assumed by economists that human capital theory could be directly applied to training. The implication was that employers would only fund 'specific training'; they would consider that their employees might leave the organisation and that some of the training benefits would be lost to them. Some attempt was made to build models in which both the costs and benefits of training, whether specific or general, were shared by employers and employees, endogenising wages and employee tenure (Bosworth et al., 1994). While such models might be a move in the right direction, they fail to explore the employee/employer relationship in which social and psychological factors come to the fore.

3.2. The training environment

3.2.1. A nuanced view of employer training

The economic approach to training ignores several key dimensions of the real world:

(a) the centrality of the individual who receives the training;
(b) the benefits of cooperative rather than competitive outcomes;
(c) that training is generally part of a broader framework of work organisation;
(d) how training can central depending on the goals and strategies of the enterprise.

An improved model of the training environment should account for what training can offer to both parties (employers and employees) and make the gains from cooperative behaviour explicit.

3.2.2. Central role of the employee

While the employer may fund the training, it is the employee who receives the training; employees differ in their motivation to train and in their ability to absorb the skills that the training attempts to impart. Training is unlikely to be successful

([6]) Blaug, for example, outlines nine types of economic and non-economic spillovers that result from improvements in education.

([7]) Wolfe and Zuvekas (2000) outline a range of positive educational spillovers on social activities, e.g. civic activities, health, crime, etc.

where the trainees have negative attitudes to training (OECD, 2003; WMRO, 2006), or where key managers have reservations about training or see it as a threat to their own security (Didato, 1976). Some important personal barriers to training (Statistics Canada, 2002), including a fear of it, have been identified in literature; these need to be overcome if the individual is to participate successfully.

Even if reluctant workers can be persuaded to train, this does not guarantee that they learn the skills taught or apply those skills in practice (Bosworth and Stanfield, 2009). Neither does successful completion of training mean that newly acquired skills are utilised in a way that both meets the work expectations of the trainee and produces the benefits that the employer anticipates. Because of the special nature of labour as a factor of production (Bosworth et al., 1996), employers have limited control over what workers do and, in the extreme, over whether the worker supplies their labour services to that employer or not.

3.2.3. Benefits of cooperative behaviour

The success of employer training seems to depend on cooperative rather than competitive behaviour. Many results in empirical literature seem to be consistent with the human relations school of thought, that organisational creativity, flexibility and prosperity derive from employee development (Shafritz and Ott, 1992); the results shown below strongly support this hypothesis, at least in the case of employer training. This literature has long indicated the need to develop and maintain trust between management and group members to ensure organisational success (McGregor, 1967; Argyris, 1973; Baird and St-Amand, 1995a, 1995b).

Cooperation may not involve a rationalised giving and returning culture of the type described by Akerloff (1982), where the act of giving (funding training) automatically results in reciprocity by the workers (greater commitment and motivation). Cooperation is likely to be much more subtle, built up over time and working through the ethos of the organisation. Training may not be a separate or separable entity, but part of a broad system of work organisation and working practices. The easier it is to separate training from other employer and employee activities, the easier it is to focus on the (financial) costs and benefits of training as an isolated activity, and the more likely the participants are to consider their own individual gains, rather than ‘identify’ with the organisation. Also, when separated out, the net present value of doing training may be negative, but when it is part of a broader system, the returns may be positive.

This does not mean that both the employee and the employer do not have their own goals, but that there is a recognition and acceptance that these goals

are better served, at least in the long term, by coexistence and 'cooperation'. This depends on the existence of conditions both within and outside the enterprise in which both the employer and the employee perceive that long term benefits will emerge. If one of the partners takes the short-term benefit (e.g. an employee moves to a higher paying employer), both may be worse off in the longer term than if they had allowed the benefits of the training to emerge and be shared.

This discussion broadly reflects how the empirical results are explored. For example, is it possible to identify elements of working conditions — primarily related to skill development — which are viewed positively by both employees (e.g. raising their job satisfaction) and employers (e.g. raising the productivity of the firms in that sector)? In practice, as demonstrated below, employer funded training is one of the few skill development activities that have a positive impact on both parties.

3.2.4. Work organisation and high performance work practices

Historically, employee commitment to training could be incentivised by the desire for promotion within the hierarchical structure of the internal labour market. Vestiges of internal labour markets may still be found in medium-sized and large companies and certain public sector organisations; however, the recent past has seen increasingly fuzzy boundaries among organisations (Bosworth, 2005; 2004), less hierarchical structures and more devolved responsibilities. Better performing workplaces have also been linked with the adoption of a raft of high performance work practices (HPWPs), making the returns from training more difficult to assess. Many HPWPs are linked to the existence of 'better jobs' (jobs that enable employees to 'learn and grow' — see the later results), and raise the employee commitment and motivation.

It might be thought that the movement away from more hierarchical structures would undermine the role of training, but this is not the case. Management science literature, in particular, now recognises the workforce as being central to the efficient operation of modern enterprises and a key source of competitive advantage (Pfeffer, 1994; Prahalad, 1983; Wright et al., 1994). Hence, success requires the maintenance and development of entrepreneurial skills, and appropriate human resource development to ensure employees have better skills than competitors (Pfeffer, 1994). It is the quality of human resource management, and the associated training and working environment, that determines these skills (Adler, 1988), hence, '[…] the effective management of human capital, not physical capital, may be the ultimate determinant of firm performance' (Youndt, et al., 1996). While empirical literature suggests that the enterprise appears to benefit disproportionately from the synergies that 'bundles'

of new practices (including training) and new forms of working offer (Bosworth, 2005), the present results find little support for this hypothesis; further work on the specification and estimation of this model is required.

3.2.5. Goals and strategies

This leads the discussion to the crucial issue of why firms differ in their adoption of training and/or bundles of HPWPs that may include training, and the implications of this for underlying employee satisfaction (Tamkin et al., 2008). The focus here is on HPWPs literature which is concerned with the 'fit' of the various policies (Huselid, 1995), in particular:

(a) the 'internal fit' concerns the compatibility of the different elements of the bundle of human resource management policies chosen and the extent to which complementarities emerge from that mix;

(b) the 'external fit' concerns the compatibility of the 'suite' of human resource management policies adopted with the enterprise's broader competitive strategies (i.e. goals and product market strategies, such as cost saving versus quality improving).

It seems likely that the 'external fit' will be a stronger influence in determining training and other forms of skills development than the 'internal fit'. A main determinant of product market strategy is the nature and degree of competition for the products and services produced: this competition shapes the opportunity set of the enterprise and is an external force that enterprises ignore at their peril. The competition in the market in which the firm sells will come from other firms in the same sector. The enterprise will compare the improvements in performance from a quality-increasing strategy vis-à-vis a cost and price reduction strategy (Bosworth, 2005). If the former offers greater improvement, the effects on the skill level of the enterprise is more likely to be positive than if the latter is the case.

So are there any sorts of activities that cost-reducing firms might introduce that would make higher levels of skills development efficient, the 'internal fit' argument? This seems unlikely, particularly as competition tends to increase over the life cycle of a product or service, which is also the stage when the work is moved to countries where wages are lower at each skill level than in the domestic economy. Enterprises, at this stage of the life cycle, are less likely to invest in modern equipment and up-skilling their workforce.

3.3. Sectors matter

It seems likely that sectors will matter in a very real sense when considering investment in skills. Sectors matter because they tend to be based on common

technologies, common products or both (Bosworth and Stanfield, 2009). There will also be sectoral differences in the ways in which the end consumer is approached (e.g. how products and services are marketed and provided), as well as differences in what consumers expect in terms of price, quality and services. This suggests that there may be a fairly high degree of commonality in the skills required in all but the most idiosyncratic, firm-specific, skills within a sector, but larger differences among sectors. It also suggests that sectoral differences may impinge on the level and nature of training expenditures and other skill development activities.

Sectors differ in their maturity and rate of product and/or process innovation. Such factors also give rise to sector-specific implications for the mix and level of skills required, with more innovative sectors generally associated with higher levels of training (Pavitt, 1984). In some sectors, new innovative products are emerging, which may require new types and levels of education and skills. In other sectors, there may still be the opportunity for process improvements, whose development and introduction may be skill-increasing, but whose longer term use may be skill-decreasing.

The degree to which the benefits of technological change can be appropriated also differs across sectors. Most science and technology based sectors allow, subject to certain conditions, technological improvements to be protected by patents. Patents give a monopoly over the technology to the inventor for a period of up to 20 years (25 years in the case of pharmaceutical products under certain circumstances). Insofar as the intellectual property system encourages product innovation, it is also likely to increase the demand for skills; where it simply protects a monopoly position with no further invention and innovation, it may have a deleterious effect on skills demand. Sectors will differ in their skills demands according to the degree of incentive they have to invent and innovate, with a general — though not universal — expectation that more rapid product change will be more demanding in terms of skills.

Product maturity, in particular, is likely to influence the firm's competitive environment, with important implications for levels of training. This is partly a question of market structure but, more important, of the firms' goals and product market strategies (where price competition is a less important driver of skills than product specification and quality). During the early stages of product life, firms may have at least a temporary monopoly, based on trade secrets, idiosyncratic skills or working practices, and intellectual property rights. However, as the product matures, other firms learn how to produce it, invent around the property rights or the property rights lapse. This opens up the market to increases in

competition and increasing downward pressure on prices and costs, which is also more consistent with the deskilling of production.

Also, in the early stages, competition often comes from domestic sources, before being opened up to competition from other advanced countries. As the product matures, however, production may move to lower cost countries. Throughout this process, sectors with maturing products will face increasing pressure on prices and costs, shifting increasing numbers of producers from quality to cost competition, lowering skill needs and reducing the incentive for training. Associated industrial restructuring is also likely to impact on the returns on training for the employer because of the increased rate of labour turnover in companies (the wastage rate).

Sectors are also one of the most important dimensions from the perspective of policy intervention and for stimulating skills development ([8]).There seem to be strong grounds for believing there is a greater commonality of skill needs at sectoral level. Poaching undermines the private rate of return on sector specific skills training and, hence, collective, sector-wide action may be required. There are likely to be significant returns from increasing the pool of skills at sectoral level; employers within the sector will be the main beneficiaries of the increased sector pool of skills and should be expected to contribute to the costs of developing that pool. Employers within a sector are best suited to establishing what skills are needed within the pool.

Jagger et al. (2005) argue that different sectors tend to have different skill demands, even though the exact causes of such differences remain poorly understood. Given these differences, strategies are required to meet the needs of each specific sector; 'the UK comparative rankings in terms of both TFP [total factor productivity] levels and TFP growth range from the best of the comparative nations to the worst. This in turn means that most of the overall UK productivity position can be explained by the size of the high productivity and low productivity sectors. This suggests that the UK's productivity problem is not especially a national problem, but more a problem with a series of sectors' (Jagger et al., 2005, p. xiii).

While 'sectors matter', they are not watertight containers within which skills permanently reside. One of the key problems with the previous levy system in the UK, at least for some sectors, concerned the flows of individuals among sectors. The more important these flows are, the more the spillover problem becomes a regional or national training problem, rather than a sectoral problem. While this is

([8]) See Bosworth and Stanfield (2009) for an extended discussion.

an empirical issue, conceptual literature still points to sectors as a key way of arranging training interventions.

For all these reasons, sectors provide a prime focus for the later empirical work in this study. The present report investigates differences in the extent to which training (and other skills development activities) make different contributions to employee satisfaction across sectors and give rise to different contributions to productivity growth across sectors. It also addresses whether the sectors where such activities make a higher contribution to job satisfaction (a higher 'gift' from the employer to the employee) are also the sectors in which such activities are associated with higher productivity growth (a higher 'gift' from the employee to the employer).

3.4. Conclusions

Traditional economics, in particular, human capital theory, provides limited insights about what the optimal level of individual and enterprise-funded training might be from an economic perspective. These limitations can be traced to its separation of training from other enterprise activities and to its focus on the employee and employer pecuniary returns. While the resulting dichotomous outcome with regard to the distribution of funding of training, in which the individual pays for general training and the enterprise for specific training, had some appeal, in retrospect, it now seems to be a 'blind alley'.

The focus of the present study is the social returns on training, particularly from employer and sectoral perspectives. In the present study social returns have a different meaning from the one usually adopted in economics ([9]). On the one hand it refers to the overall level of satisfaction individuals obtain from their work, i.e. what level of satisfaction do individuals working in a particular sector achieve given the working conditions and, in particular, the skills development activities of that sector? On the other hand, what are the overall benefits obtained by the employing firms in that sector, from the increased motivation and commitment of the individuals in that sector. Both of these (employee satisfaction and firm performance) can be viewed as economic surpluses; the question addressed in the empirical work reported below concerns the effect that training has on each of these surpluses across sectors.

([9]) In economics, the difference between the social and private returns in terms of the costs and benefits of training that are not captured by the individual or enterprise funding the training.

While the offer of employer training may be viewed as a 'partial gift exchange' insofar as employees reciprocate in ways favourable to the firm, literature suggests that such an exchange needs to be nuanced in terms of occurring in an environment conducive to the development and maintenance of fairness, trust and cooperation. In addition, literature suggests that training should not be seen as a separate and separable activity, but part of a raft of high performance work practices which have internal fit (e.g. practices which complement one another) and external fit (e.g. practices consistent with the firm's broader product market strategies and goals). External and internal fit will exhibit important sectoral differences, which will reflect aspects such as the maturity of the product or process and the extent of domestic and foreign competition.

Where the environment is appropriate, literature suggests that a HPWP package that includes training:

(a) offers employees non-pecuniary benefits, which result in improvements in attitudes to work (e.g. identification with the organisation) and therefore greater effort and more inventive contributions that improve the performance of the enterprise ([10]);

(b) offers employers a mechanism by which they can fully exploit the benefits of the newly acquired skills in their production activities, e.g. by changing the methods of production — work organisation — or the nature of the product offer to consumers.

However, the present study finds little support for a role for skills development — other than employer-funded training — in the firm performance equations, either individually or in various 'bundles'; this is an area for further research. The results reported in the present study are more consistent with the relatively slow adoption of HPWPs and the fact that they are not as widespread as expected, given a number of earlier more positive studies about their benefits (Tamkin et al., 2008).

This suggests that the value employees place on the offer of training can be judged from what this training would do to the employee surplus. Similarly, the value of any reciprocation by employees in terms of greater commitment and effort will be reflected in the surplus of the employers hiring labour, which is proxied in the empirical work by labour productivity. What happens to wages remains potentially important insofar as the wage rate forms the dividing line that separates the two surpluses, but the ability of employers to offer non-wage

([10]) This is consistent with the important finding that most employees claim that changes in worker attitudes and abilities would bring about the greatest improvement in the performance and productivity of their companies or organisations (Clarke, 1980).

benefits in the form of improved working conditions reduces the reliance of the outcome on wage adjustments, which are often difficult to achieve. The use of the surplus concepts within the analysis of training investment (and other skills development activities) appears novel and quite distinct from the main economic focus on the rate of return on training based mainly on wages and profits.

Table 1 **Ease of introduction of skill development activities, ceteris paribus (expected outcomes in a 'gift exchange' environment)**

		Impact on job satisfaction		
		Significant positive	**Insignificant (from 0)**	**Significant negative**
Impact on productivity	**Significant positive**	Employer and employee both positive	Employer proposes and worker resistance low	Employer proposes and worker resistance high
	Insignificant (from 0)	Employee proposes and employer resistance low	No incentive for either group to propose	No incentive for employers to propose and employees would resist
	Significant negative	Employee proposes and employer resistance high	No incentive for employees to propose and employers would resist	Employer and employee both negative

Table 1 sets out a framework that will be used in bringing together the empirical results, based upon a more nuanced version of 'gift exchange'; it shows the hypothetical relationship between productivity, job satisfaction, and skill development activities. The upper left-hand section indicates where there may be a set of skill development activities which have a significant and positive impact on both productivity and job satisfaction, with benefits to the employer and the employee. In the bottom left section there is a significant positive impact for the employee but a negative one for the employer; there is likely to be employee demand and support for skill development activities but employer resistance. As a final example, the bottom right-hand corner of the table illustrates that there might be a set of skill development activities that employees strongly dislike and employers perceive will adversely affect their performance. Such activities would never be suggested by either party.

Two sets of econometric analysis are reported, which enable light to be thrown on Table 1. The first set of empirical results can be found in Chapter 4, aiming to identify the influences on job satisfaction; the second set can be found in Chapter 5, which attempts to establish the influences on productivity. Both chapters use the results to identify the contribution of training and other skill development activities, in the context of job satisfaction and productivity at sectoral level. If the empirical work can find some sectors in which certain activities are positively valued by both parties, these are activities which, in

principle, should be most easily introduced. If such activities exist, it is then possible to see whether the ranking of the contributions to employee satisfaction and to firm performance are correlated.

CHAPTER 4.

Training and job quality: econometric results

4.1. Introduction

This chapter reports on the quantitative analysis which explores the relationship between training (and other forms of skill development) and the social benefits of training at sectoral level. Social benefits are defined with reference to the levels of satisfaction experienced by workers. The sectoral effect of interest is the extent to which, after controlling for a range of variables which are known to be associated with job satisfaction, there is some residual sectoral effect. This effect might be explained by, other things being equal, relatively high levels of training of activity within a given sector. It is known from the previous study that in sectors such as finance, provision of training is very much part of the social contract at sectoral level (Bosworth et al., 2010). Evidence in Cedefop (2011) also drew attention to the importance of 'bundles' of human resource strategies associated with job satisfaction. Training of one kind or another was part of the overall bundle but it needed to be delivered alongside other HPWPs to ensure benefit to the employer. This also has a sectoral dimension to it, with some sectors, such as financial intermediation, being more likely to operate high performance work practices.

The analysis provided in this chapter is based on individual level micro data from the European working conditions survey (EWCS), but with a range of sectoral variables matched to this database, primarily from the continuing vocational training survey (CVTS) (productivity data from the KLEMS database has also been matched to the ECWS, see Chapter 5).

The econometric analysis proceeds in four stages:

(a) estimation of an overall benchmark model, which examines the effects of training and other skill development variables on employee satisfaction (Section 4.3.2). This basic model is used to explore the nature of the underling relationship between training and satisfaction, which informs the subsequent empirical specifications. In addition, this model yields sectoral results in the form of:
    (i) residual sectoral effects;
    (ii) interaction between sectoral effects and training;
(b) estimation of the main model specification separately sector by sector, focusing on the role of training and skill development variables (Section

4.3.4). The aim is to attempt to isolate similarities and differences in the effects of training on employee satisfaction across sectors;

(c) incorporating sector-level variables into the main model specification. These variables are factors to do with training and come from the CVTS (Section 4.3.5). The rationale is that, in addition to the fact that variables at sectoral level measure somewhat different aspects of training, they may also reflect the spillover effects whereby the individual (and firms) benefit from the training undertaken by other organisations;

(d) a variant of the model (with no control variables) is estimated for various groups of sectors (Section 4.3.6). This approach attempts to identify patterns among sectors which are similar with regard to particular training and skills development variables.

The remainder of this chapter proceeds as follows. Section 4.2 gives a descriptive overview of the data, concentrating on satisfaction and the main training/skills development variables, offering an initial view of the relationship between job satisfaction and training. Section 4.3 discusses the econometric approach and resulting estimates. Finally, Section 4.4 presents conclusions drawn from the results of the various strands of econometric work.

4.2. Descriptive summary of satisfaction and training/skills development variables

4.2.1. Variables of interest

Before providing results from the econometric analysis, a brief description is given of the relationship between access to training and indicators of overall job satisfaction. Throughout the analysis the measure of job satisfaction used is derived from the question asked in the EWCS: ‘are you very satisfied, satisfied, not very satisfied or not at all satisfied with working conditions in your main paid job?’ The survey presents four responses to this question which have been coded as follows:

1 – not at all satisfied;
2 – not very satisfied;
3 – satisfied;
4 – very satisfied.

The satisfaction variable is ordinal in nature (e.g. it is simply a ranking of choices from the lowest level of satisfaction to the highest) and differences among categories do not indicate any particular degree of change in the level of

satisfaction. For example, a response of 4 (very satisfied) does not indicate that an individual is twice as satisfied as if they indicated 2 (not very satisfied). This ordinal nature of the satisfaction variable is important in terms of the choice of method used to estimate the relationship (e.g. estimation needs to be carried out using an ordered logit model which is presented in Section 4.3).

Several training and skills development variables are included in the present analysis, three being of particular interest:

(a) the incidence of training and its duration;
(b) the degree to which individuals feel that they have opportunities to 'learn and grow' at work;
(c) the frequency with which individuals are able to use their own ideas at work.

These variables, and their relationship with job satisfaction, are explored more thoroughly than the others.

The rationale for including these variables is that while training provides the skills required to be competent (i.e. being able to do one's job), where skills have already been acquired, it is the opportunity to use them which further contributes to job satisfaction (and, potentially, increase productivity where those skills are employed effectively).

The sector level averages of job satisfaction and the training variables are provided in Table 2. In all sectors, more than half of respondents were 'satisfied' or 'very satisfied' with their overall working conditions: this is not surprising since where people are dissatisfied they tend to leave that employment. From a sectoral perspective, the average satisfaction level ranges from 2.6 (or between 'not very satisfied' and 'satisfied') in agriculture, hunting, forestry and fishing, to 3.1 (between 'satisfied' and 'very satisfied') in financial intermediation and auxiliary activities. The average for all sectors is 3.0 indicating that, on average, workers are satisfied with their jobs.

4.2.2. Training incidence and skill development across sectors

In Table 2, 'received training' indicates the percentage of workers who have been in receipt of employer-provided training over the last 12 months. Within each sector, less than 50% of workers had received employer-provided training over the past 12 months. The percentage of workers receiving such training ranges from 8% in the manufacture of textiles, to 49% in financial intermediation and auxiliary activities. Across all sectors, 28% of individuals had received employer-provided training in the last 12 months.

'Training days' sets out the average number of days of employer-provided training received by workers in a sector (excluding any workers who had not received training). The average number of days of training ranges from 8.4 days

in manufacture of furniture and recycling to 26 days in publishing, printing and reproduction of recorded material. Across all sectors, the average number of training days is 11.8.

'Opportunities to learn and grow at work' measures the individual's level of agreement that they have such opportunities on the following scale:

1 – strongly disagree;
2 – disagree;
3 – neither agree nor disagree;
4 – agree;
5 – strongly agree.

The average level of agreement for all sectors is 3.3, indicating that, on average, workers slightly agree that they have such opportunities at work. The average by sector ranges from 2.5 in agriculture, hunting, forestry and fishing and private households (not much opportunity) to 3.8 in financial intermediation and auxiliary activities (a strong opportunity to do so).

Finally, 'able to use own ideas at work' measures how often workers feel that they are able to use their own ideas in their day-to-day jobs. It has the following scale:

1 – almost never;
2 – rarely;
3 – sometimes;
4 – often;
5 – almost always.

On average, across all sectors, people indicate that they were able to use their own ideas at work relatively frequently, with the average being 3.7 (between 'sometimes' and 'often'). The average value for this variable within each sector ranges from 3.0 in the manufacture of textile or leather products to 4.3 in education.

Table 2 **Sector-level averages of main variables**

Sector	Satisfac-tion	Received training (%)	Training days	Opportunities to learn and grow at work	Able to use own ideas at work
Agriculture, hunting, forestry and fishing	2.6	8	9.9	2.5	3.9
Mining and quarrying	2.8	35	13.6	2.9	3.3
Manufacture of food/tobacco products	2.9	20	11.4	2.9	3.3
Manufacture of textile or leather products, etc.	2.7	8	16.4	2.7	3.0
Manufacture of wood or paper products	2.8	21	12.4	3.1	3.1
Publishing, printing and reproduction, etc.	3.0	21	26.0	3.3	3.7
Manufacture of coke, refined petroleum etc.	2.9	31	10.0	3.2	3.4
Manufacture of metal products, machinery …	2.9	25	13.0	3.2	3.5
Manufacture of electrical machinery, etc.	2.9	36	12.1	3.3	3.5
Manufacture of transport equipment	2.9	33	15.3	3.2	3.3
Manufacture of furniture or recycling	2.9	15	8.4	3.2	3.6
Electricity, gas and water supply	3.1	36	9.5	3.5	3.7
Construction	2.9	17	12.3	3.3	3.8
Wholesale and retail trade; repair of motors, etc.	3.0	20	11.0	3.2	3.6
Hotels and restaurants	2.9	12	9.3	3.0	3.6
Land transport	2.9	24	10.2	2.9	3.3
Water transport; air transport; etc.	3.0	34	15.0	3.3	3.5
Post and telecommunication	3.0	36	8.5	3.2	3.3
Financial intermediation; activities auxiliary to finance, etc.	3.2	49	11.4	3.8	3.7
Real estate activities and other business activities	3.1	32	11.0	3.7	3.9
Public administration and defence; social security …	3.0	42	14.2	3.6	3.5
Education	3.1	43	11.8	3.7	4.3
Health and social work	3.1	43	11.6	3.6	3.7
Other community, social and personal activities	3.1	24	11.8	3.3	3.8
Private households with employed persons	2.9	10	10.2	2.5	3.7

4.2.3. Sectoral patterns

Figures 2 to 6 reveal the sectoral pattern in the data between levels of job satisfaction and the various training and training-related variables presented in

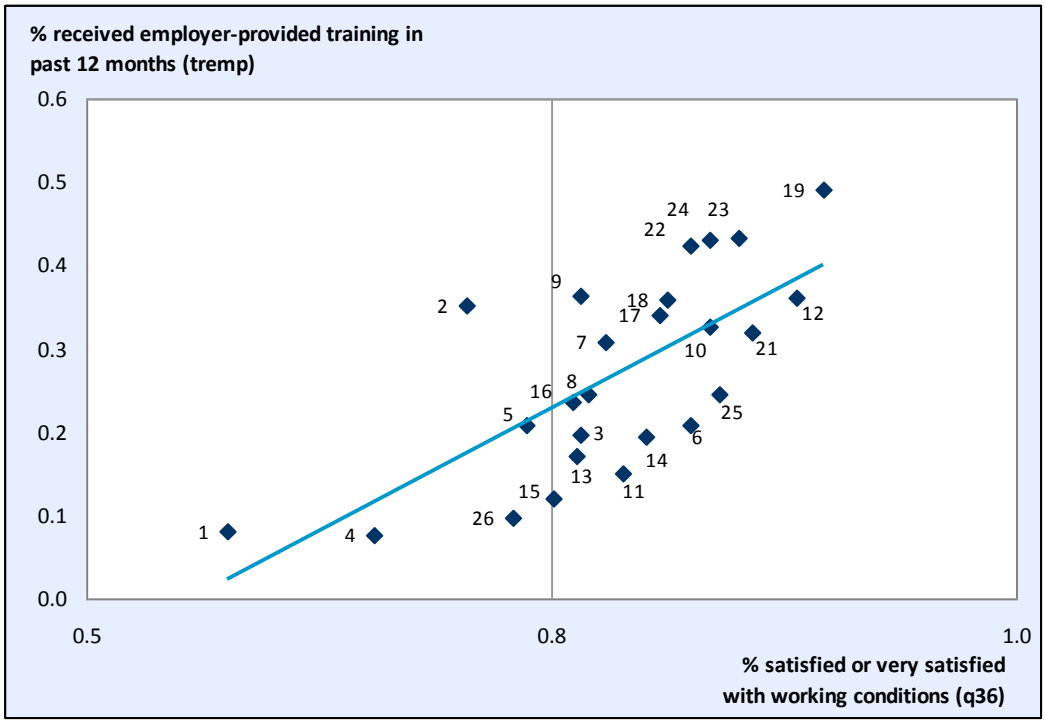
Table 2. For ease of presentation in the figures, sectors have been labelled numerically (see Box 2 for a key to the sectors).

Box 2 **Numerical labels for sectors**

Sector 1	Agriculture, hunting, forestry and fishing
Sector 2	Mining and quarrying
Sector 3	Manufacture of food/tobacco products
Sector 4	Manufacture of textile or leather products, etc.
Sector 5	Manufacture of wood or paper products
Sector 6	Publishing, printing and reproduction of recorded media
Sector 7	Manufacture of coke, refined petroleum, chemicals, etc.
Sector 8	Manufacture of metal products, machinery and equipment
Sector 9	Manufacture of electrical machinery, radio, television, etc.
Sector 10	Manufacture of transport equipment
Sector 11	Manufacture of furniture or recycling
Sector 12	Electricity, gas and water supply
Sector 13	Construction
Sector 14	Wholesale and retail trade; repair of motor vehicles
Sector 15	Hotels and restaurants
Sector 16	Land transport
Sector 17	Water transport; air transport; supporting transport activities
Sector 18	Post and telecommunication
Sector 19	Financial intermediation; activities auxiliary to finance, etc.
Sector 21	Real estate activities and other business activities
Sector 22	Public administration and defence; compulsory social security
Sector 23	Education
Sector 24	Health and social work
Sector 25	Other community, social and personal activities
Sector 26	Private households with employed persons

Sectors are shown in Figure 2 by the proportion of individuals within each sector who had received employer-provided training over the past year and the percentage reporting job satisfaction (i.e. satisfied or very satisfied) with working conditions. In Figure 2, there appears to be a reasonably consistent cross-sectoral pattern linking a higher incidence of training with greater satisfaction with working conditions. This pattern extends from sector 1 (agriculture, forestry, fishing) in the bottom left hand corner (i.e. relatively low incidence of training and relatively low reported satisfaction) through to sector 19 (financial intermediation and auxiliary activities) in the top right hand corner (i.e. a high incidence of training and high reported satisfaction).

Figure 2 **Incidence of employer-provided training and job satisfaction by sector**



NB: for sectors labels see Box 2.

Table 3 groups sectors according to whether they are relatively high/low training sectors ([11]) (more than/less than 25% received employer-provided training) and whether they are sectors with high/low satisfaction (more than/less than 75% of workers are 'satisfied' or 'very satisfied). Within 11 of the 25 sectors, more than 25% of employees received employer-provided training and more than 75% were satisfied/very satisfied with their working conditions. Within nine sectors, more than 75% were satisfied/very satisfied with their working conditions but less than 25% received employer-provided training. There is an interesting mix of sectors in the high satisfaction/high training segment of the table: a mix of public sector, high value sectors (finance), and highly regulated sectors from a health and safety perspective (chemicals, transport, etc.). The classification of sectors here is conditional on the thresholds for each variable being considered.

([11]) The threshold for low or high variables is arbitrary though consideration has been given to the presentation of these sectors in the figures. Within sectors, the proportion of all workers that report that they are 'satisfied' or 'very satisfied' with their workings conditions ranges between 50 and 100% so that the high/low threshold has been set at 75% for this variable. The proportion of employees who received training ranges between 0 and 50% so that the threshold for this variable has been set at the midpoint of 25%.

Changing this threshold would change the categorisation of sectors. The high/low expression is relative.

Based on the 75% threshold, only five sectors are considered to be 'low satisfaction': agriculture, hunting, forestry, fishing; mining and quarrying; manufacture of textile or leather products; manufacture of wood or paper products; and private households with employed persons. Among these 'low satisfaction' sectors only one, mining and quarrying, is considered to be 'high' in terms of training provision.

Among the sectors where less than 25% of workers received employer-provided training, it was only in agriculture, forestry, fishing, manufacture of food, manufacture of wood, and private households, that fewer than 75% of workers indicated that they were satisfied/very satisfied with their job.

Table 3 **Sectors by high/low employer-funded training and job satisfaction**

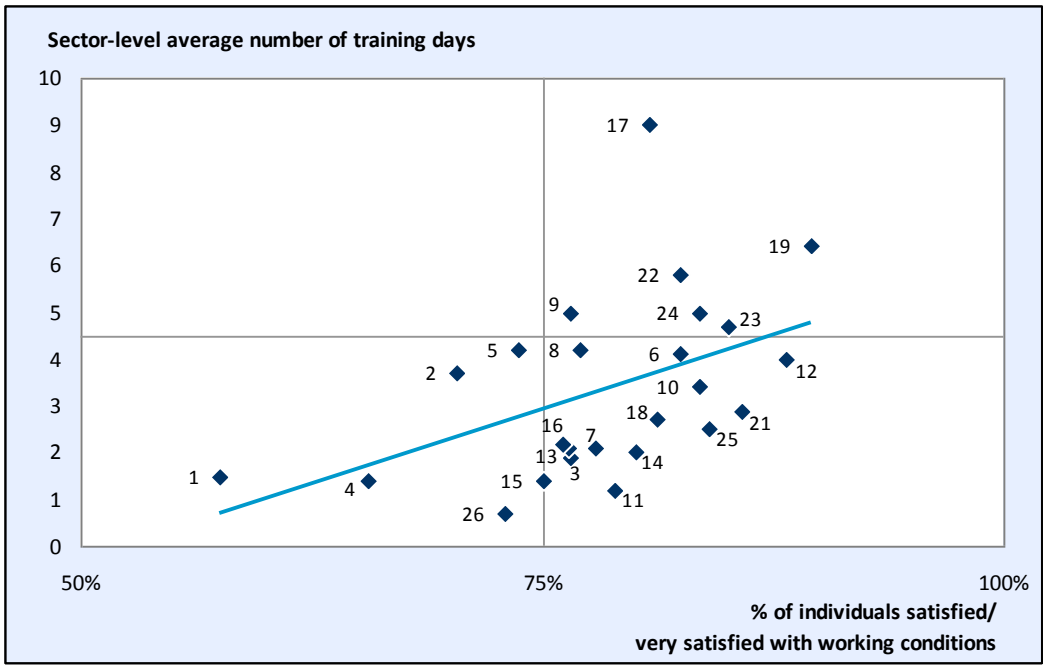
High training (>50%), high satisfaction (>75%)
Manufacture of coke, refined petroleum, chemicals, plastics, etc.
Manufacture of electrical machinery or, radio, television, etc.
Manufacture of transport equipment
Electricity, gas and water supply
Water transport; air transport; supporting transport activities
Post and telecommunication
Financial intermediation; activities auxiliary to finance, etc.
Real estate activities and other business activities
Public administration and defence; compulsory social security
Education
Health and social work
Low training (<50%), high satisfaction (>75%)
Manufacture of food/tobacco products
Publishing, printing and reproduction of recorded media
Manufacture of metal products, machinery and equipment
Manufacture of furniture or recycling
Construction
Wholesale and retail trade; repair of motor vehicles
Hotels and restaurants
Land transport
Other community, social and personal activities
Low training (<50%), low satisfaction (<75%)
Agriculture, hunting, forestry and fishing
Manufacture of textile or leather products, etc.
Manufacture of wood or paper products
Private households with employed persons
High training (>50%), low satisfaction (<75%)
Mining and quarrying (C)

Figure 3 shows the proportion of employees reporting that they were ‘satisfied’ or ‘very satisfied’ with their working conditions, and the average number of training days (provided to those who received any employer-provided training) by sector. The average duration of training varies across sectors, ranging from less than one day in private households with employed persons to nine days in water transport, air transport and supporting activities. However, a weakly positive relationship between satisfaction and duration of training at sector level is observed in Figure 3.

Table 4 divides the sectors into groups according to whether they have high/low job satisfaction and high/low average number of training days. The average number of training days has been calculated for all workers belonging to each sector (the duration of training for those workers who had not received any training is set to zero), so this is a measure of training intensity that compounds the length of the training period with the percentage of workers receiving training. The high/low threshold of training days is set at 4.5 days so that sectors in which the average is higher (lower) are considered high (low) sectors. There are no sectors in which a low number of training days coincides with high satisfaction. Most sectors (19 out of 25) are considered low in terms of training days. Few sectors have average training days of more than 4.5: manufacture of electrical machinery or radio, television, etc.; water transport, air transport, supporting transport activities; financial intermediation and auxiliary activities; public administration and defence and compulsory social security; education; and, health and social work. In all of these more than 75% of workers reported that they were satisfied or very satisfied with their working conditions.

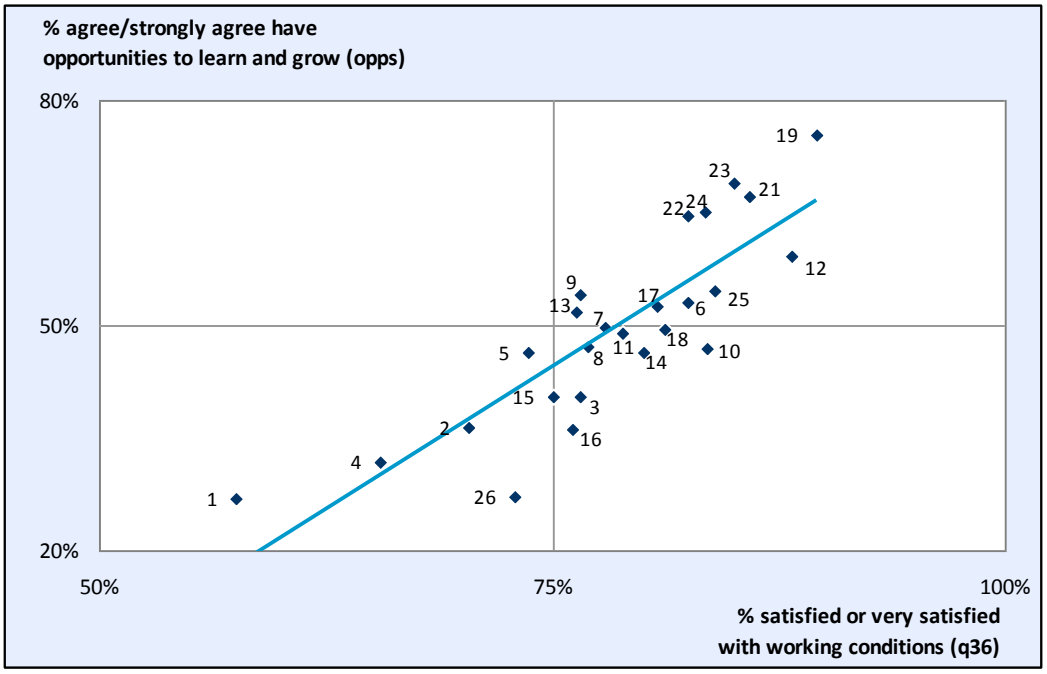
Alongside the provision of employer-funded training, the skills development variable of interest is the degree to which workers ‘agree’ or ‘disagree’ that they have opportunities to learn and grow in their job. The proportion who ‘agreed’ or ‘strongly agreed’ that they had these opportunities compared with the proportion of workers who indicated that they were ‘satisfied’ or ‘very satisfied’ with their working conditions is illustrated by sector in Figure 4. A summary of sectors by high/low opportunities and satisfaction is presented in Table 5. In no sector where more than 50% of the sample agreed/strongly agreed that they had opportunities for learning and growth at work did fewer than 75% indicate that they were satisfied/very satisfied overall. Fewer than 50% of individuals within a number of sectors felt that they had opportunities to learn and grow. In five of these sectors this coincided with fewer than 75% being satisfied/very satisfied with their overall working conditions.

Figure 3 **Proportion satisfied/very satisfied and average number of training days by sector**



NB: For sectors labels see Box 2.

Figure 4 **Agreement with 'opportunities to learn and grow' and satisfaction with working conditions by sector**



NB: For sectors labels see Box 2.

Table 4 **Sectors by high/low employer funded training days and job satisfaction**

High training days (>4.5 days), high satisfaction (>75%)
Manufacture of electrical machinery or, radio, television, etc.
Water transport; air transport; supporting transport activities
Financial intermediation; activities auxiliary to finance, etc.
Public administration and defence; compulsory social security
Education
Health and social work
Low training days (<4.5 days), high satisfaction (>75%)
Manufacture of food/tobacco products
Publishing, printing and reproduction of recorded media
Manufacture of coke, refined petroleum, chemicals, plastics, etc.
Manufacture of metal products, machinery and equipment
Manufacture of transport equipment
Manufacture of furniture or recycling
Electricity, gas and water supply
Construction
Wholesale and retail trade; repair of motor vehicles
Hotels and restaurants
Land transport
Post and telecommunication
Real estate activities and other business activities
Other community, social and personal activities
Low training days (<4.5 days), low satisfaction (<75%)
Agriculture, hunting, forestry and fishing
Mining and quarrying
Manufacture of textile or leather products, etc.
Manufacture of wood or paper products
Private households with employed persons
High training days (>4.5 days), low satisfaction (<75%)
None

Table 5 is shows a mix of public sector, high value-added sectors, and regulated ones where there is a mix of relatively high levels of job satisfaction and opportunities to learn and grow. Construction also stands out as exhibiting these characteristics.

A further important indicator of skills development is how often individuals feel that they are able to use their own ideas in their job. Where people have skills and knowledge and are not able to deploy them this can be a source of job dissatisfaction. The percentage of workers in each sector who indicated they were ‘often’ or ‘almost always’ able to use their own ideas at work, and the percentage who indicated that they were ‘satisfied’ or ‘very satisfied’ with their overall working conditions is depicted in Figure 5. Sectors are summarised by high/low ability to use own ideas and satisfaction in Table 6. In all sectors, more than 40% of workers indicated that they were able to use their own ideas in their

jobs ‘often’ or ‘almost always’. Sectors are considered to present a ‘high’ opportunity for workers to use their own ideas if more than 60% of workers in the sector indicated that they were often or almost always able to do so. As in Table 3 and 5, high satisfaction sectors are those in which more than 75% of workers were satisfied or very satisfied with their overall working conditions. A positive relationship between higher job satisfaction and greater use of one’s own ideas is indicated across the sectors but the picture is not as clear as it is for training incidence and opportunities to learn and grow.

Table 5 **Sectors by high/low ‘opportunities to learn and grow’ and job satisfaction**

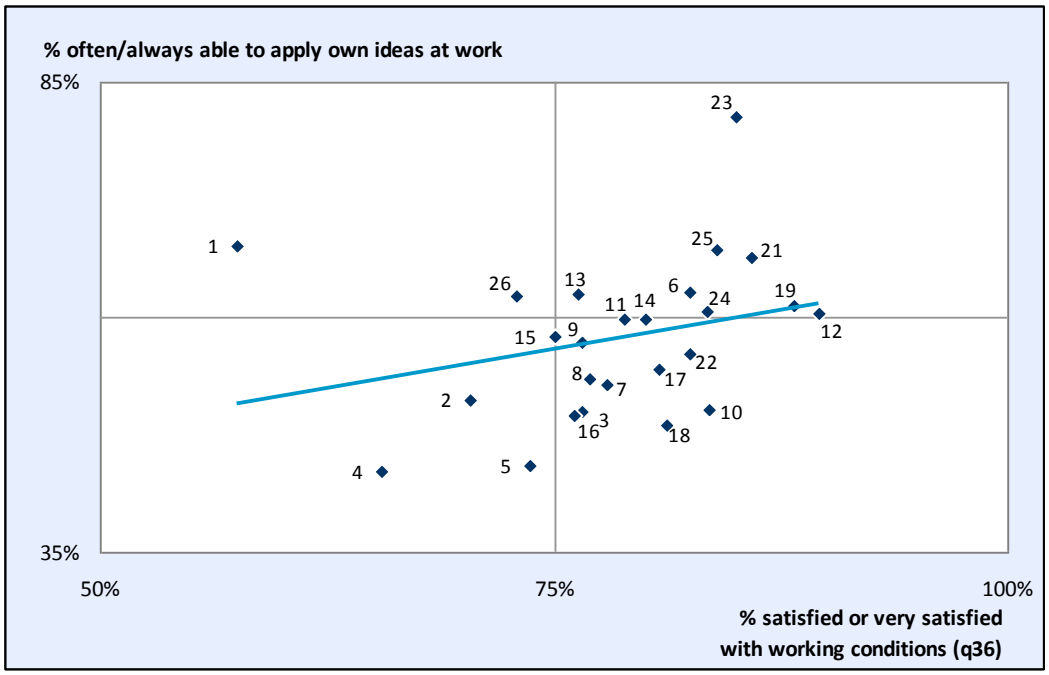
High opportunities (>50%), high satisfaction (>75%)
Publishing, printing and reproduction of recorded media
Manufacture of electrical machinery or, radio, television, etc.
Electricity, gas and water supply
Construction
Water transport; air transport; supporting transport activities
Financial intermediation; activities auxiliary to finance, etc.
Real estate activities and other business activities
Public administration and defence; compulsory social security
Education
Health and social work
Other community, social and personal activities
Low Opportunities (<50%), high satisfaction (>75%)
Manufacture of food/tobacco product
Manufacture of coke, refined petroleum, chemicals, plastics, etc.
Manufacture of metal products, machinery and equipment
Manufacture of transport equipment
Manufacture of furniture or recycling
Wholesale and retail trade; repair of motor vehicles
Hotels and restaurants
Land transport
Post and telecommunication
Low Opportunities (<50%), low satisfaction (<75%)
Agriculture, hunting, forestry and fishing
Mining and quarrying
Manufacture of textile or leather products, etc.
Manufacture of wood or paper products
Private households with employed persons
High Opportunities (>50%), low satisfaction (<75%)
None

Table 6 **Sectors by high/low 'ability to apply own ideas' and job satisfaction**

High application of own ideas (>60%), high satisfaction (>75%)
Publishing, printing and reproduction of recorded media
Electricity, gas and water supply
Construction
Financial intermediation; activities auxiliary to finance, etc.
Real estate activities and other business activities
Education
Health and social work
Other community, social and personal activities
Low application of own ideas (<60%), high satisfaction (>75%)
Manufacture of food/tobacco products
Manufacture of coke, refined petroleum, chemicals, plastics, etc.
Manufacture of metal products, machinery and equipment
Manufacture of electrical machinery or radio, television, etc.
Manufacture of transport equipment
Manufacture of furniture or recycling
Wholesale and retail trade; repair of motor vehicles
Hotels and restaurants
Land transport
Water transport; air transport; supporting transport activities
Post and telecommunication
Public administration and defence; compulsory social security
Low application of own ideas (<60%), low satisfaction (<75%)
Mining and quarrying
Manufacture of textile or leather products, etc.
Manufacture of wood or paper products
High application of own ideas (>60%), low satisfaction (<75%)
Agriculture, hunting, forestry and fishing
Private households with employed persons

The familiar pattern emerges, with the public sector, finance and business services, construction, electricity gas and water, and selected manufacturing sectors being the ones with relatively high scores on both indicators.

Figure 5 **Degree to which individuals are able to apply own ideas at work and satisfaction with working conditions by sector**



NB: For sectors labels see Box 2.

4.2.4. Emerging patterns

As in the case of the relationship between the incidence of training and satisfaction with working conditions, there is also a clear positive relationship between the ability to 'learn and grow' and the satisfaction with working conditions across sectors. The positive relationship which appears in Figure 4 is better determined (e.g. more tightly defined around a straight line sloping from bottom left to top right) in this instance than in the case of Figure 2. Sector 1 (agriculture, hunting, forestry and fishing) again lies furthest to the bottom left (low opportunities to 'learn and grow', coupled with low satisfaction) and sector 19 (financial intermediation and auxiliary services) again lies at the top right (high opportunities to 'learn and grow', coupled with high satisfaction).

As Tables 3 to 6 indicate, there are some distinctive patterns by sector. If the upper right quadrant in Figure 2 and 4 indicates a favourable outcome insofar as it is related to a positive association between job satisfaction, opportunities to develop and grow, and access to training and development, then it is typically public sector activities which are prominent (public administration, education, and health). Finance, real estate and other business activities, and electricity gas and water supply are also found in these quadrants in both figures (2 and 4). In estimating the model of job satisfaction with the full set of training variables included — reported later in the chapter — the set of variables reflecting

opportunities to learn and grow at work (variables: opps_1 to opps_5) were found to be significant, positive, and monotonically increasing in the degree of opportunity. The coefficient estimates for these variables showed the greatest level of consistency across sectors and across different versions of the model which included and excluded other variables. The EWCS reveals that the percentage of individuals who agreed or strongly agreed that they have opportunities to learn and grow at work ranged between 20% and 80% across sectors, demonstrating considerable variation among sectors.

Table 7 summarises all sectors according to their respective positions in Figures 2 to 5: whether they are considered low/high sectors in terms of satisfaction, training incidence, opportunities to learn and grow, and the application of workers' own ideas on the job. Five sectors are considered high across all four variables:

(a) electricity, gas and water supply;
(b) financial intermediation and activities auxiliary to finance services;
(c) real estate and other business activities;
(d) education;
(e) health and social work.

Two sectors, manufacture of textile or leather products and manufacture of wood or paper products, are categorised as 'low' across all four dimensions.

In six sectors where satisfaction was high, there was low training incidence, low opportunities to learn and grown and low use of workers' own ideas:

(a) manufacture of food/tobacco products;
(b) manufacture of metal products, machinery and equipment;
(c) manufacture of furniture and recycling;
(d) wholesale and retail trade, repair of motor vehicles;
(e) hotels and restaurants;
(f) land transport.

In these six sectors, job satisfaction is relatively high despite the development opportunities being relatively low (at least in terms of the three measures indicated) so other factors must be more dominant in determining overall satisfaction with working conditions. In the remaining 14 sectors where job satisfaction was high, at least one of the skills development measures (i.e. training, opportunities, use of own ideas) was categorised as high. In the 20 sectors with 'high' overall satisfaction, eleven had 'high' incidence of training, 11 had 'high' opportunities to learn and grow and 8 had 'high' use of workers' own ideas.

Table 7 **Sectors by high/low satisfaction and main training/skills development variables**

	Satisfaction	Training	Opportunities to learn and grow	Able to use own ideas
Agriculture, hunting, forestry and fishing	low	low	low	high
Mining and quarrying	low	high	low	low
Manufacture of food/tobacco products	high	low	low	low
Manufacture of textile or leather products, etc.	low	low	low	low
Manufacture of wood or paper products	low	low	low	low
Publishing, printing and reproduction of recorded media	high	low	high	high
Manufacture of coke, refined petroleum, chemicals, etc.	high	high	low	low
Manufacture of metal products, machinery and equipment	high	low	low	low
Manufacture of electrical machinery, etc.	high	high	high	low
Manufacture of transport equipment	high	high	low	low
Manufacture of furniture or recycling	high	low	low	low
Electricity, gas and water supply	high	high	high	high
Construction	high	low	high	high
Wholesale and retail trade; repair of motor vehicles	high	low	low	low
Hotels and restaurants	high	low	low	low
Land transport	high	low	low	low
Water transport; air transport; supporting transport activities	high	high	high	low
Post and telecommunication	high	high	low	low
Financial intermediation; activities auxiliary to finance	high	high	high	high
Real estate activities and other business activities	high	high	high	high
Public administration and defence; compulsory social security	high	high	high	low
Education	high	high	high	high
Health and social work	high	high	high	high
Other community, social and personal activities	high	low	high	high
Private households with employed persons	low	low	low	high

4.3. Modelling the relationship between training and job satisfaction

4.3.1. The approach taken

Several approaches and model specifications were considered to examine the relationship between training/skills development and job satisfaction,. As an overarching approach, satisfaction is first specified as a function of various

components related to individual characteristics, working conditions and other characteristics of one's job and sector. In general terms, this can be set out as: $S_i = f(A_i, B_j, C_k)$ where S_i is workers' reported satisfaction with their job on a four-point scale. The overall focus of the present research is the role of the 'skills development' variables, but sectoral differences in the underlying relationship are also considered.

The modelling discussed in this chapter is presented in several stages. First is a basic model which looks directly at the interaction of employer-provided training and sector. Then there is a more detailed model with variables related to skills development. The results for the main model are presented and discussed in relation to estimates that were obtained through running the model on all sectors pooled and for each sector individually. Then, the main model is modified to include sector level variables. Finally, the main model is estimated for various groups of sectors.

4.3.2. The basic model

Before exploring the detailed relationships between training (and other skills and development measures) and satisfaction with working conditions, it is useful to look at a relatively basic model relating training to satisfaction and how this varies across sectors. This basic model includes variables related to several employee characteristics that are typically found to affect reported level of job satisfaction, including prior level of education and gender. The job factors controlled for include part-time versus full-time employment, income, occupation, working conditions (e.g. whether subject to hazardous conditions, interaction with public, etc.), and employer size. Also controlled for are sector (25 sectors) and country, with related to skills development and training variables included in the specification. The main variables of interest concern employer-provided training, including a binary indicator of whether or not an individual received employer-provided training (1 received training; 0 did not receive training) and the number of days of such training received (and days-squared). The dummy variable for training was interacted with the sector indicator to observe whether there is a separate effect of training on job satisfaction within various sectors.

The results for the main training variables and the interaction of training and sector are shown in Table 8. The results for the interaction terms include only those for which the resulting estimates were found to be statistically significant. The coefficient estimates for the three main training variables (whether or not received training, training days and days-squared) were found to have the expected signs and were statistically significant. The dummy variable for training had a positive coefficient, indicating that receipt of training increases job

satisfaction, all other things being equal. The coefficient for training days was also greater than zero, while the coefficient on the days-squared was negative, indicating that satisfaction increases with the number of days of training received by an individual but the size of the increase declines with each additional day of training (i.e. diminishing returns). For 10 of the 25 sectors the interaction between training and sector was statistically significant and for all 10 the estimated coefficient was negative, indicating that, in that sector, receipt of training is found to reduce overall satisfaction with working conditions (compared to the reference sector, agriculture, hunting, forestry and fishing), all other things being equal (i.e. all other dummy variables set to their reference categories as set out in Table 9). The sectors for which this finding arises vary in their nature. Two manufacturing sectors and construction exhibit this result. The other sectors for which a negative effect of training is found include post and telecommunications, financial services, and public sector (administration, education and health). Given what is known about these sectors — from the bivariate analysis in Section 4.2 — this seems counter-intuitive and is explored in greater detail in the main model reported below.

Table **8** **Basic model results**

		β
	Received training	0.645
	Number of days	0.014
	Training days-squared	-5.21e-05
Interaction among training and sectors:	Manufacture of textile or leather products, etc.	-1.082
	Manufacture of wood or paper products	-1.408
	Construction	-0.819
	Post and telecommunication	-1.197
	Financial intermediation; activities auxiliary to finance	-1.156
	Real estate activities and other business activities	-0.731
	Public administration and defence; compulsory social security	-1.077
	Education	-1.044
	Health and social work	-1.244
	Other community, social and personal activities	-0.891

4.3.3. Main model

4.3.3.1. *Content of the main model*

While the basic model provides information regarding sectoral patterns in the relationship between training/skills development and job satisfaction, further analysis is required. A detailed model, with many training/skills development variables was estimated for all sectors pooled (with a dummy variable indicating the sector) and for each sector separately (see Table 9 for a full list of the

additional variables). In using more variables in the specification an important limitation arose in that it was impractical for interaction terms to be included. In exploring the model specification it was found that the addition of these variables resulted in little change to the main training/skills development coefficient estimates. To ease interpretation and presentation of results, the control variables were omitted from the main model reported here ([12]).

Before explicitly considering sectoral variations and patterns in the relationships between job satisfaction and training/skills development, it is useful first to consider these relationships at individual level. This is done in Section 4.3.3.2. These results give a clear indication of which influences are important in determining individual job satisfaction. Sections 4.3.4 onwards explore sectoral differences in the influences on job satisfaction at sectoral level, and look at the contributions of these influences on overall levels of job satisfaction in each of the sectors.

Table **9** **Description of the full range of explanatory variables included in the main model**

Variable name	Description
tremp	whether or not individual received employer-provided training
tremp_ds	number of days training received
tremp_d2	days-squared
tremploy	whether or not individual undertook training provided themselves
tremploy_ds	number of days of this training
tremploy_d2	days-squared
education	highest level of education (ref: less than level 1)
onjobtrain	whether received on the job training
onsiteoth	whether received other onsite training
edleave	whether took educational leave
complex	whether job involves complex tasks
solveprob	whether job requires problem solving
How often job is intellectually demanding? (ref: almost never)	
intelldemand_rare	rarely
intelldemand_some	sometimes
intelldemand_often	often
intelldemand_always	always

([12]) Results from the model which included the control variables are available from the authors.

Variable name	Description
Agreement that job provides opportunities to learn and grow (ref: strongly disagree)	
opp_disagree	disagree
opp_neutral	neither agree nor disagree
opp_agree	agree
opp_strong agree	strongly agree
rotatenew	job involves rotation of tasks that requires different skills
skillunder	needs further training for current duties
skillover	skills suit more demanding duties than current
Control variables	
country	country (ref: UK)
sector	sector (ref: agriculture, hunting, forestry and fishing)
occupation	occupation (ref: elementary occupations)
income	income (ref: lowest bracket)
employer size	employer size (ref: less than two employees)
type of employment	self-employed; employee, employed, other
sex	sex (ref: female)
working conditions	working conditions (four different variables)

4.3.3.2. *Individual level results*

The results from the main model, which includes all explanatory variables (Table 9), are provided in Table 10.

Table 10 **Job satisfaction and training (ordered logit) with and without control variables**

Explanatory variables	no control variables	with control variables
Employer-provided training		
Received training (ref: no training)	0.072	-0.145*
Number of days	0.0116***	0.0132***
Days-squared	-4.65e-05***	-4.84e-05***
Employee-provided training		
Received training (ref: no training)	-0.324**	-0.0271
Number of days of this training	-0.001	-0.003
Days-squared	0.000	0.000
Agreement that job provides opportunities to learn and grow (ref: strongly disagree)		
Disagree	0.412***	0.348***
Neither agree nor disagree	1.091***	1.000***
Agree	1.648***	1.426***
Strongly agree	2.447***	2.223***
How often able to use own ideas on job (ref: almost never)		
Rarely	0.136	0.031
Sometimes	0.254***	0.281***
Often	0.590***	0.606***
Almost always	0.818***	0.877***
Skill mismatch (ref: present skills sufficient)		
Needs further training for current duties	-0.443***	-0.363***
Skills suit more demanding duties than current	-0.153***	-0.127**

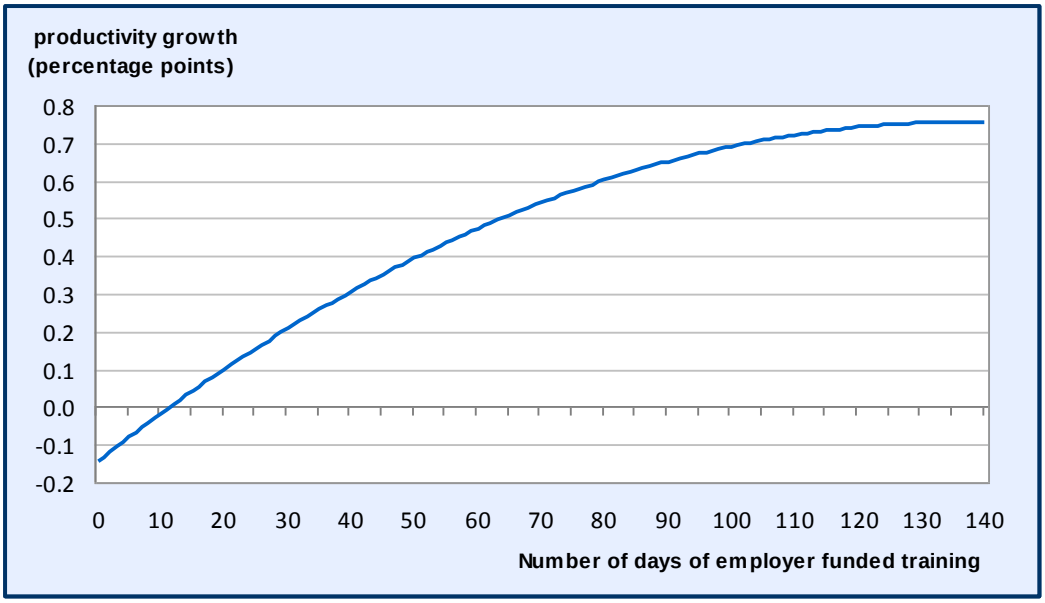
Received on the job training	0.031	-0.097
Received other onsite training	-0.181**	-0.252***
Took educational leave	0.082	0.000694
Job involves complex tasks	-0.110**	-0.148**
Job requires problem solving	-0.202***	-0.212***
How often job is intellectually demanding (ref: almost never)		
Rarely	-0.086	-0.072
Sometimes	0.036	0.060
Often	0.000	-0.020
Almost always	0.060	0.058
Number of years with company	0.00530**	0.00960***
Main job involves learning new things (ref: no)	-0.222***	-0.0937
Main job involves rotation of tasks that requires different skills	-0.111**	0.000539

NB: The additional variables controlled for in the second column of results are: part-time versus full-time employment, income, occupation, working conditions, employer size; sector and country; ancillary parameters not shown; * indicates statistical significance at 1% level; ** at 5% level; *** at 10% level.

Employer-provided training is found to have a positive impact on employee satisfaction with overall working conditions without control variables; when the control variables are included in the model, the effect of this indicator is washed out and the resulting coefficient estimate is negative. The number of employer-provided training days that an individual receives, however, has a positive and statistically significant impact on satisfaction, whether or not the control variables are included in the specification.

Differentiating the quadratic relationship with respect to the number of training days and setting the result equal to zero indicates that not only does the marginal satisfaction with training fall, but it eventually becomes negative. This occurs at 132.5 days (e.g. about one-third of a year), after which total satisfaction begins to fall with additional training (Figure 6). In practice, very few individuals will have such high levels of training (e.g. only 1% of those in receipt of employer funded training have over 100 days of training). The shape of the curve is primarily driven by the feelings of most individuals with lower levels of training and the upper reaches of the curve should be treated more as a ‘projection’ of what might happen with training for that many days.

Figure 6 **Effects of employer training on individual satisfaction (ordered logit results)**



The negative starting position is also of interest and needs further investigation. If this finding is correct, then it may be expected to find negative coefficients on employer-funded training for groups where the period of training is short. It also suggests that short periods of training may be resisted by individuals and so be less productive than the employer might hope. The result is consistent with the idea that sustained levels of training are required to generate commitment and motivation.

Employee-provided training obtains a negative coefficient in both specifications, indicating that where workers fund their own training, there is lower overall satisfaction with working conditions, on average. Causality here may be reversed, with individuals funding their own training because they are dissatisfied with their working conditions; the training may help them find another job with better conditions.

The effect of the indicator of agreement/disagreement that their job provides opportunities to learn and grow is one of the most consistent and strongest observed among the training/skills development variables. Satisfaction increases monotonically with the extent to which the individual feels that they can ‘learn and grow’; the effect remains strong even with the inclusion of all the control variables. Similarly, the impact of how often individuals can use their own ideas in their job is positive and job satisfaction increases monotonically with the

frequency of use of one's own ideas. Only the variable for 'rarely' is not statistically significant but this variable still has a positive coefficient.

The match between a worker's skills and their job is also found to have a statistically significant effect on job satisfaction. The reference here is that workers' existing skills are sufficient for performing the duties required in their current job. Compared to this group, individuals who are either under-skilled (i.e. they need further training for their current job) or over-skilled (i.e. their skills suit more demanding duties than their current job requires) are found to have lower job satisfaction, with a larger negative impact associated with being under-skilled than being over-skilled. Note that this says nothing about the absolute skill level of the individuals: they might be highly skilled, but still not have sufficient skills for the job or have quite low skill levels, but undertake menial tasks which do not fully utilise the skills they have.

Having received on-the-job training or taking educational leave are not found to have a statistically significant on job satisfaction in either of the specifications reported in Table 10. Having received other onsite training has a negative estimated coefficient that is statistically significant.

A job that involves complex tasks is associated with lower job satisfaction (negative coefficient); the same is found for a job that requires problem-solving. The coefficients for both are statistically different from zero. The negative coefficient on these variables indicates that they most likely reflect difficult jobs characterised by 'fire-fighting'.

The number of years of working for the organisation is generally used as an indication of learning by doing. The coefficient is positive and significant, but it might also be caused by the fact that individuals who are more satisfied by their working conditions stay in the job for longer.

In both the overall results and the separate results by sector (discussed in Section 4.3.4), non-linearities in the training variable have been investigated. Employer-funded training is entered with the number of days of training and the number of days of training squared. This allows examination of whether there are some values of training days that still yield a positive impact on individual satisfaction, even if, for example, the coefficient on the indicator of employer-provided training is negative. This analysis is also repeated sector by sector to see if there are any key cross-sectoral patterns or key differences among sectors in the way in which training influences satisfaction with working conditions.

4.3.4. Sectoral patterns

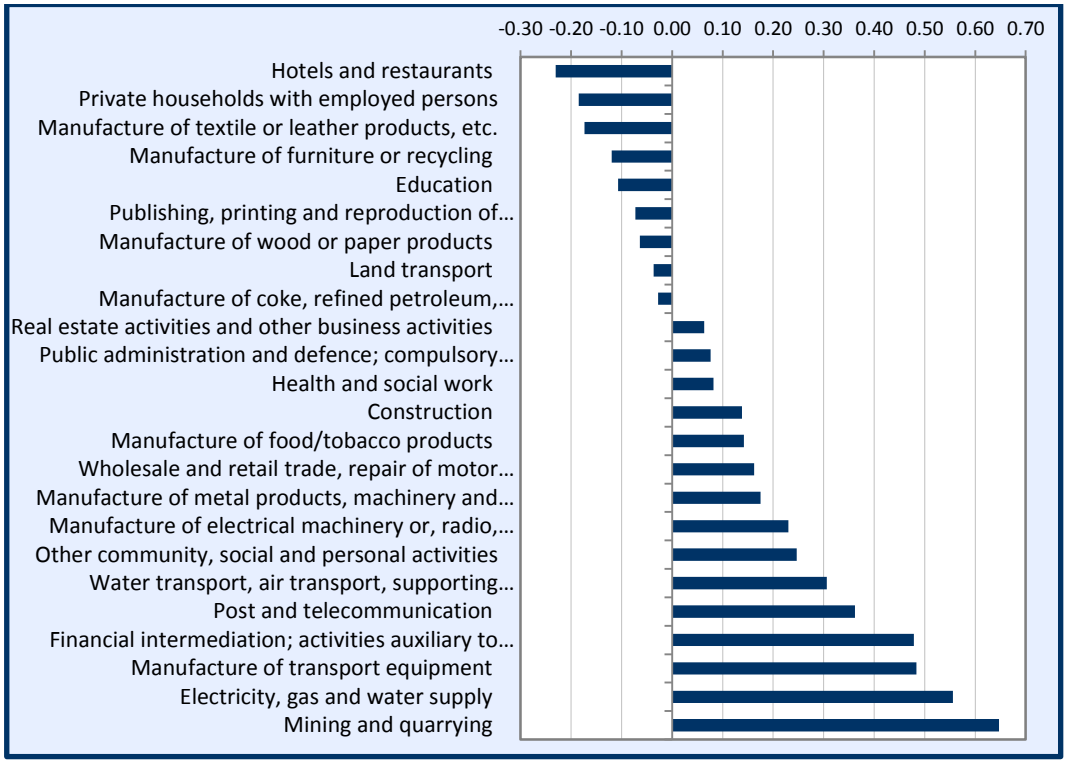
4.3.4.1. *Residual sector effects*

In the main pooled model, dummy variables for sector were included, with agriculture, hunting, forestry and fishing being the reference sector. The sector dummy variables pick up any residual sectoral effects not accounted for by the other explanatory variables. Having controlled for a wide variety of skill development and other factors, there may be residual sectoral effects. These effects are generally linked to factors that are difficult to quantify, such as the ethos and culture of a sector, locational factors, and differing degrees of government support (Figure 8).

The estimated residual sectoral effects should be treated with some caution for several reasons. First, the coefficient estimates are all relative to the base sector, in this case, agriculture, forestry, fishing. Hence, all of the coefficients could be positive (if all sectors have higher residual satisfaction than the base group) or negative (if all sectors have lower residual satisfaction). The reported significance is only relative to the base group, such that separate calculations have to be made for any other pairing of sectors than the one involving the base group. Finally, it is important to recognise that this is a residual measure, because a sector might, for example, exhibit a strong and significant negative coefficient, but, when allowance is made for all aspects of skills development and other factors, it might be a high performing sector in terms of satisfaction with working conditions.

Four sectors have significantly higher residual sectoral effects than the base group: financial intermediation (coefficient of 0.48); manufacture of transport equipment (0.48); electricity, gas and water (0.56) and mining and quarrying (0.64). The present results suggest that financial intermediation is generally a high performing sector in terms of having working conditions with high levels of satisfaction, hence the residual effect is in the same direction as the other influences. In Cedefop (2011) the highest ranked sectors were also ones in which overall levels of satisfaction with various aspects of working conditions improved most between 2000 and 2005 (e.g. the manufacture of transport equipment improvements in times and hours of work).

Figure 7 **Residual sectoral effects on satisfaction with working conditions**



The sectors with the lowest residual satisfaction (compared to the base sector, agriculture, forestry, fishing and hunting) are manufacture of furniture or recycling (-0.12), manufacture of textile or leather products (-0.17), private households with employed persons (-0.18), and, hotels and restaurants (-0.23). Several sectors in the lowest residual category were also among those that showed the greatest relative decline in certain aspects of working conditions over the period 2000 to 2005 (e.g. the effects of increased violence and discrimination in the workplace in reducing satisfaction with working conditions in the hotels and restaurants sector).

4.3.4.2. *Sector-by-sector estimates*

To explore any similarities or differences among sectors in the relationship between training/skills development and job satisfaction more fully, the main model set out above was also estimated for each sector separately. Such an analysis is asking a lot of the data for several sectors. In moving from the overall sample, with over 25 000 observations, to the sector level, the average sample size is just 1 000 observations; given that some sectors are smaller than others, this creates further pressure on the data in the smaller sectors, most particularly when the control variables are present. To minimise the occurrence of non-

convergence when estimating the model by sector, the control variables are not included in the in the results discussed below ([13]).

The full results of the sector-by-sector modelling are not presented due to the high number of sectors and variables involved in the estimation. To ease presentation and interpretation, Table 11 gives the coefficients on only the employer-provided training variables (whether training provided, number of days training, and days-squared). The dummy variable, which indicates whether or not an individual received employer-provided training, was statistically significant in only three sectors: agriculture, hunting, forestry and fishing; manufacture of furniture and recycling; and land transport. In these three sectors the sign indicated a positive relationship between job satisfaction and the receipt of employer-provided training. These three sectors have relatively low incidence of training (less than 25%) and low opportunities for workers to learn and grow (less than 50% agreed or strongly agreed that such opportunities are present in their current job) as discussed in Section 4.2.4.

The number of days of such training was found to be statistically significant in five sectors: publishing; manufacture of furniture and recycling; construction; real estate activities and other business activities; and health and social work. Of these five industries, job satisfaction was found to increase with the number of days of training received in all but manufacture of furniture and recycling. The number of days squared had the expected negative coefficient in five of the seven sectors in which the coefficient estimates were statistically significant.

Including all sectors, regardless of the statistical significance of coefficients, the results confirmed positive impact of training and days of training (with a negative quadratic term) on job satisfaction in most sectors. Positive coefficients were obtained for 15 of the 25 sectors for the dummy variable. Of the sectors obtaining a negative effect of whether training was received was, more than 25% of workers in all except education, received employer-provided training. 16 out of 25 sectors were found to have a positive association between the number of training days and job satisfaction. The coefficient on days-squared was negative in 16 out of 25 sectors.

The sector-by-sector results suggest that the combined effects of employer-provided training and number of days of such training will be positive across a fairly wide range of sectors for sufficiently high numbers of training days and that their combined effect might be significantly different from zero.

([13]) The model did not converge for several sectors when the full set of skills development variables and control variables were included. Without the control variables, the model converged for all sectors but, in some instances, some observations were completely determined making the standard errors questionable.

Table 11 **Sector-by-sector results for the effects of employer-funded training on job satisfaction (ordered logit)**

Sectors	Employer-provided training	Number of days training	Training days-squared
	B	β	β
Agriculture, hunting, forestry and fishing	0.911*	-0.014	0.000
Mining and quarrying ([a])	-0.389	-0.051	0.001
Manufacture of food/tobacco products	0.347	0.004	0.000
Manufacture of textile or leather products, etc.	0.705	0.016	0.000
Manufacture of wood or paper products	0.470	-0.007	0.000
Publishing, printing and reproduction of recorded media ([a])	-0.392	0.190***	-0.000521***
Manufacture of coke, refined petroleum, chemicals, etc.	0.368	0.049	0.000
Manufacture of metal products, machinery and equipment	0.542	0.012	0.000
Manufacture of electrical machinery or radio, television, etc.	0.012	-0.011	0.000
Manufacture of transport equipment	0.181	0.006	0.000
Manufacture of furniture or recycling	1.461*	-0.374***	0.00549**
Electricity, gas and water supply	-0.526	0.075	0.000
Construction	0.022	0.0504**	-0.000252***
Wholesale and retail trade; repair of motor vehicles	0.049	0.009	0.000
Hotels and restaurants ([a])	0.412	-0.119	0.003
Land transport	1.090***	-0.059	0.000
Water transport; air transport; supporting transport activities ([a])	-0.417	-0.043	0.001
Post and telecommunication	-0.723	0.095	-0.00150*
Financial intermediation; activities auxiliary to finance ([a])	-0.151	-0.064	0.000690*
Real estate activities and other business activities	-0.074	0.0425*	-0.000401**
Public administration and defence; compulsory social security	-0.292	0.018	0.000
Education	0.282	0.005	0.000
Health and social work	-0.297	0.0258**	-9.06e-05***
Other community, social and personal activities	-0.077	0.016	0.000
Private households with employed persons ([a])	2.144	-0.839	0.0545*

Ancillary parameters not shown. * indicates statistical significance at 1% level; ** at 5% level; *** at 10% level
([a]) One or more cases was completely determined by the model. Standard errors are questionable.

4.3.5. Incorporating sector-level data and high performance working practice indicators at sectoral level

The analysis so far has considered only data at individual level; the inclusion of sector-level information is now considered. The main rationale for the inclusion of sector level variables is to ascertain whether individuals obtain satisfaction from working in a sector characterised by particular conditions or practices, particularly in terms of training activity. Training at sector level can supplement influences on job satisfaction at individual level in several ways. First, some empirical evidence

suggest that individual incomes (and thereby job satisfaction) may be raised by the skills of colleagues ([14]). Second, there is potentially a spillover effect from working in a high training/high skill sector, with potential future employers seeing merit in them having worked in a high training sector. Third, if they change employer within the sector, workers may be more likely to move into more skilled work with training opportunities. Finally, even if an individual has not been in receipt of training, they may derive satisfaction from working in a high skill environment.

The CVTS offers a wide range of training variables which can be matched to EWCS at sector level. The sector level variables cover different aspects of training from individual level variables (e.g. how much is spent on training and the proportion of the employer's costs that can be attributed to lost output or to direct expenditure on training). Similarly, the CVTS allows indicators of HPWPs to be incorporated into the analysis. There are several strands of this literature but the key focus appears to be the role of human resource management and HPWPs in promoting and developing the resources available to the enterprise, and in determining how such resources are organised and incentivised (Bosworth, 2005). In this theory, training, in particular, is seen as a part of a complementary package of good working practices.

The CVTS variables introduced into the analysis are based on 22 sectors ([15]) for which the data are available, within the EU-27. Descriptions of the CVTS variables included in the analysis are shown in Table 12. Each of the variables included are at sector level within each country so that individuals in the same sector and in the same country have the same values for these variables as others in the same sector and country. The CVTS variables focus on the costs of training and the proportion of enterprises providing various types/forms of training within sectors (within countries).

([14]) Spillovers from working alongside a more qualified workforce, such as the 'current spillover income gains' were proposed by Blaug (1968), whereby the presence of more skilled workers raises the income level of the less skilled. Empirical support for this hypothesis can be found in Battu et al., 2004.

([15]) The CVTS variables are at sector level within each country. Where the CVTS sectors contained more than one of the EWCS sectors, the same value (within each country) was ascribed to all those sectors. Description of the sectors that were combined are noted with Table13.

Table 12 **Continuing vocational training survey variables**

Variable name	Description
adjdcpart	Adjusted direct cost per (training) participant
adjlcpart	Adjusted labour cost per (training) participant
adjdcee	Adjusted direct cost per employee
adjlcee	Adjusted labour cost per employee
adjdceecvt	Adjusted direct cost per employee in CVT enterprises
adjlceecvt	Adjusted labour cost per employee in CVT enterprises
adjdcthr	Adjusted direct cost per training hour
adjlcthr	Adjusted labour cost per training hour
adjdc	Adjusted direct cost
adjlc	Adjusted labour cost
hrsee	Average hours of training (all types) per employee
allhrscvt	All individuals hours in CVT per employee
allhrspart	All individuals hours of participants in CVT
anytrain	Proportion of enterprises providing any type of training
cvt	Proportion of enterprises providing CVT
anyother	Proportion of enterprises providing any other form of training
anytypefrm	Proportion of enterprises providing any type or form
cvtstation	Proportion of enterprises providing CVT in workstation
jobrotate	Proportion of enterprises providing job rotation, etc.
learnqual	Proportion of enterprises providing learning quality circles, etc.
selflearn	Proportion of enterprises providing self-learning
confws	Proportion of enterprises providing conferences, workshops, etc.
internal	Proportion of enterprises internal training
external	Proportion of enterprises providing external training

To investigate the influence of HPWPs by sector, two variables were introduced into the model of job satisfaction. Both HPWP variables indicate the sector-level average (within each country) of involvement in HPWP. The first of these HPWP variables relates to task rotation, teamwork and devolved decision-making. The second HPWP variable relates to incentive structures. Self-employed individuals were excluded from the HPWP analysis.

Table 13 **Proportion of enterprises providing any training by sector based on CVTS variables**

Sector	Average % providing any training
Mining and quarrying	57%
Manufacture of food and tobacco	52%
Manufacture clothes, textiles, leather	35%
Manufacture of wood prod, furniture and recycling ([a])	48%
Manufacture of pulp, paper and publishing, printing, etc.	61%
Manufacture of chemicals, rubber, etc.	66%
Manufacture of metals, fabricated metal products	63%
Manufacture of machinery, equipment , instruments, etc. ([b])	71%
Manufacture of motor vehicles and other transport equip.	73%
Electricity, gas and water supply	82%
Construction	55%
Sale, maintenance, repair motor vehicles and motorcycles	71%
Wholesale trade and commission trade, except motor vehicles	62%
Retail trade, except of motor vehicles and motorcycles	52%
Hotels and restaurants	42%
Land, water, air transport, support activities	55%
Post and telecommunications	68%
Financial and insurance	90%
Activities auxiliary to financial intermediation	78%
Real estate and other business activities	75%
Public admin, education, health, social, etc. ([c])	65%
Agriculture, hunting, forestry, fishing	not available in CVTS
Household activities and extra-territorial	not available in CVTS

([a]) Combines manufacture of wood or paper products and manufacture of furniture and recycling from EWCS sectors (Box 1).
([b]) Combines manufacture of metal products, machinery and equipment with manufacture of electrical machinery or radio, television, etc., from EWCS.
.([c]) Combines public administration and defence and compulsory social security; education; health and social work; and other community, social and personal activities.

The estimated ordered logit indicates that many of the CVTS variables are not significant in determining job satisfaction. Various specifications (in terms of the explanatory variables that were included) were considered. When more individual level variables were included, fewer CVTS variables were found to be statistically significant. The focus for this discussion is the specification set out as the main model (Section 4.3.3; Table 9) but without any of the control variables ([16]). Table 14 sets out the estimated coefficients that were statistically

([16]) The inclusion of controls with sector dummies does not 'wash out' the role of the CVTS variable (it is the sector dummies that become insignificant); however, the inclusion of the country dummies washes out almost all of the effects of the CVTS variables. It seems that the cross-country variation is driving much of the power of the CVTS effects in explaining satisfaction with working conditions, rather than the cross-sectoral variation.

significant (with the exception of the indicator of whether or not employer-provided training was received) for the CVTS variables, the HPWP indicators, and the variables related to employer-provided training. Five of the CVTS variables were statistically significant. Significant positive coefficients were found on the proportion of enterprises that provide any form of training, the proportion of enterprises that provide self-learning, and the proportion that provide conferences, workshops, etc.; a negative coefficient was found for the proportion of enterprises that provide external training. For those with a positive coefficient, the higher the proportion of enterprises undertaking such activity in the sector (by country), the greater the probability that individuals within that sector report higher levels of overall satisfaction with working conditions.

Table 14 **Statistically significant coefficient estimates for CVTS, HPWP and employer-funded training variables**

	β
Adjusted direct cost per training hour	0.0120*
Adjusted labour cost per training hour	-0.0276**
Proportion of enterprises providing any type of training	0.0189*
Proportion of enterprises providing CVT in workstation	0.0124***
Proportion of enterprises providing conferences, workshops, etc.	0.0162***
HPWP related to remuneration incentives	-1.5350***
employer-provided training	-0.1060
number of days training	0.0114**
training days-squared	-3.53e-05*

* Indicates statistical significance at 1% level; ** at 5% level; *** at 10% level.

The coefficient on the HPWP variable summarising the use of remuneration incentives indicates a negative effect of such practices on job satisfaction. Such incentive systems may be a source of pressure and anxiety, rather than a source of satisfaction. Additional regressions were carried out including interaction terms, mainly involving the interaction of incidence of training with some of the CVTS, HPWPs and skills mix variables. Several of these showed significant coefficients; for example, the cross product of whether or not employer-provided training was received and the use of HPWP related to remuneration incentives showed a significant positive coefficient at the 10% level, suggesting that the pressure and anxiety of pay incentive systems may be ameliorated to some degree by training.

The strongest and potentially most interesting of these results is for the proportion of enterprises that provide any type of training. The significant positive coefficient for this variable is found across many model specifications and coincides with statistically significant results for the number of employer-provided

training days (positive coefficient) and days-squared (negative coefficient). This suggests some support for the spillover hypothesis: that the provision of any form of training at sector level adds to job satisfaction over and above the direct effects of training experienced by the individual.

4.3.6. Modelling by groups of sectors

To identify sectoral patterns in the relationship between job satisfaction and training, the main model (see Section 4.3.3) was estimated for various groups of sectors where groups were defined according to patterns in the data set. Sectors were grouped according to whether they could be considered high, medium or low in terms of the following variables (with each variable considered independently of the others): job satisfaction; HPWPs (related to task rotation, teamwork and decision-making); opportunities to learn and grow ([17]); skill needs; and workers' ability to use their own ideas on the job.

With respect to job satisfaction, taking the proportion of individual responses in each of the four categories (not at all satisfied; not very satisfied; satisfied; very satisfied) the sectors were grouped into low, medium and high satisfaction sectors. Sectors categorised as being low satisfaction sectors were those in which more than 25% of responses were 'not at all satisfied' or 'not very satisfied'. Sectors were grouped as high satisfaction sectors if more than 25% in the sector were 'very satisfied'. All other sectors (where less than 25% indicated high or low satisfaction) were grouped as medium satisfaction sectors. This grouping of sectors is shown in Table 15.

When separate ordered logit models were estimated for each of these three groups of sectors, the results for the variables associated with employer-provided training varied (Table 16). For the sectors with high overall satisfaction, the indicator of whether or not an individual received training as well as the number of days of training and days-squared were statistically significant with the coefficient on the number of days being greater than zero and the other coefficients less than zero. For sectors with low overall satisfaction, the training variables were not statistically significant in determining individual level job satisfaction. For the medium sector, only days and days-squared were significant. The combined coefficients by training days are shown in Figure 8. In sectors with 'low' job satisfaction, there is a reduction in overall satisfaction when the number of days of training increases. The opposite is true in sectors with higher satisfaction ('medium' and 'high' sectors). The evidence suggests that for sectors

([17]) For this variable only two groups, high and low, were defined.

with relatively high levels of job satisfaction, the provision of employer-provided training is a significant determinant of the reported levels of job satisfaction.

Table 15 **Sectors organised according to high/medium/low reported job satisfaction**

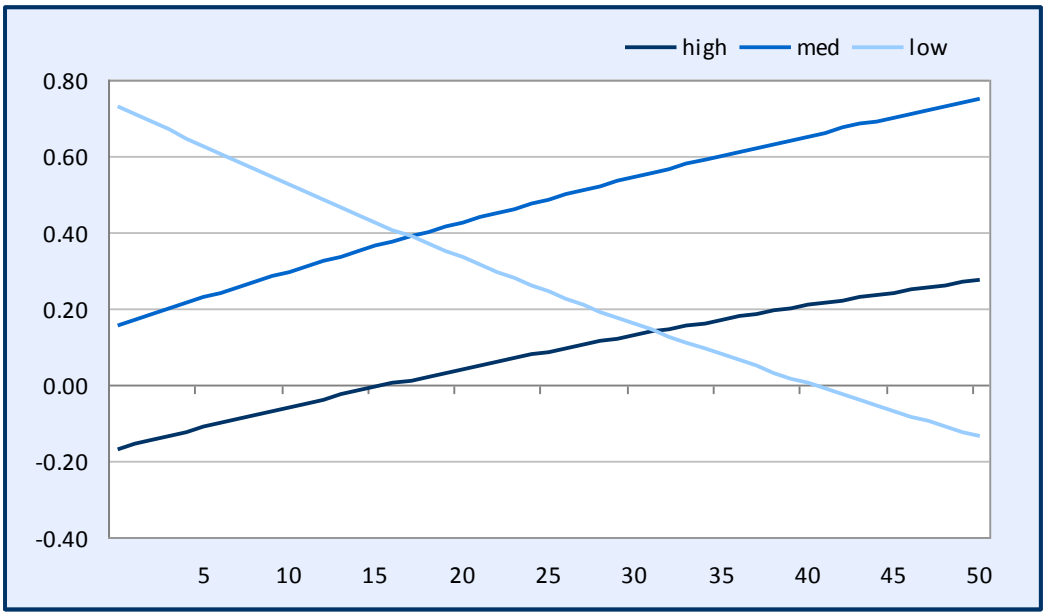
Low satisfaction
Agriculture, hunting, forestry and fishing
Mining and quarrying
Manufacture of textile or leather products, etc.
Manufacture of wood or paper products
Private households with employed persons
Medium satisfaction
Manufacture of food/tobacco products
Publishing, printing and reproduction of recorded media
Manufacture of coke, refined petroleum, chemicals, plastics, etc.
Manufacture of metal products, machinery and equipment
Manufacture of electrical machinery or, radio, television, etc.
Manufacture of transport equipment
Manufacture of furniture or recycling
Construction
Wholesale and retail trade; repair of motor vehicles
Hotels and restaurants
Land transport
Water transport; air transport; supporting transport activities
High satisfaction
Electricity, gas and water supply
Post and telecommunication
Financial intermediation; activities auxiliary to finance, etc.
Real estate activities and other business activities
Public administration and defence; compulsory social security
Education
Health and social work
Other community, social and personal activities

Table 16 **Training coefficient estimates for sectors grouped according to overall reported job satisfaction**

	High	Medium	Low
Employer-provided training	-0.2410**	-0.0636	0.0283
Number of days training	0.0144***	0.0184**	-0.0222
Training days-squared	-5.55e-05***	-6.90e-05*	7.93e-05

NB: See Table 15 for the allocation of sectors into groups; * indicates statistical significance at 1% level; ** at 5% level; *** at 10% level.

Figure 8 **Combined coefficients for training, training days and days-squared by training days for high/low opportunities sectors**



For HPWPs the sectors were divided among those falling in the bottom, middle and top thirds according to their average scores on these variables ([18]). The high-medium-low groups are summarised in Table 17. The manufacturing sectors are mainly classified as high or medium according to this grouping with only manufacture of textiles or leather considered a low sector in terms of the particular HPWP considered here.

None of the employer-provided training variables are statistically significant for sectors characterised by relatively low use of HPWP. For sectors that are characterised by relatively high use of HPWP, the impact of duration of training (and days-squared) is significant while it is the indicator of whether or not training was received that is of significance among sectors with medium use of HPWP. This suggests that training has an important role in the bundle of HPWPs and is linked to relatively high levels of job satisfaction in those sectors associated with high use of HPWPs.

([18]) The hpwp2_01 variable for each sector.

Table 17 **Sectors grouped according to high/medium/low use of HPWP**

High HPWP use
Manufacture of wood or paper products
Manufacture of coke, refined petroleum, chemicals, plastics, etc.
Manufacture of electrical machinery or, radio, television, etc.
Manufacture of transport equipment
Electricity, gas and water supply
Construction
Water transport; air transport; supporting transport activities
Public administration and defence; compulsory social security
Health and social work
Medium HPWP use
Mining and quarrying
Manufacture of food/tobacco products
Publishing, printing and reproduction of recorded media
Manufacture of metal products, machinery and equipment
Manufacture of furniture or recycling
Hotels and restaurants
Financial intermediation; activities auxiliary to finance, etc.
Education
Low HPWP use
Agriculture, hunting, forestry and fishing
Manufacture of textile or leather products, etc.
Wholesale and retail trade; repair of motor vehicles and per
Land transport
Post and telecommunication
Real estate activities and other business activities
Other community, social and personal activities
Private households with employed persons

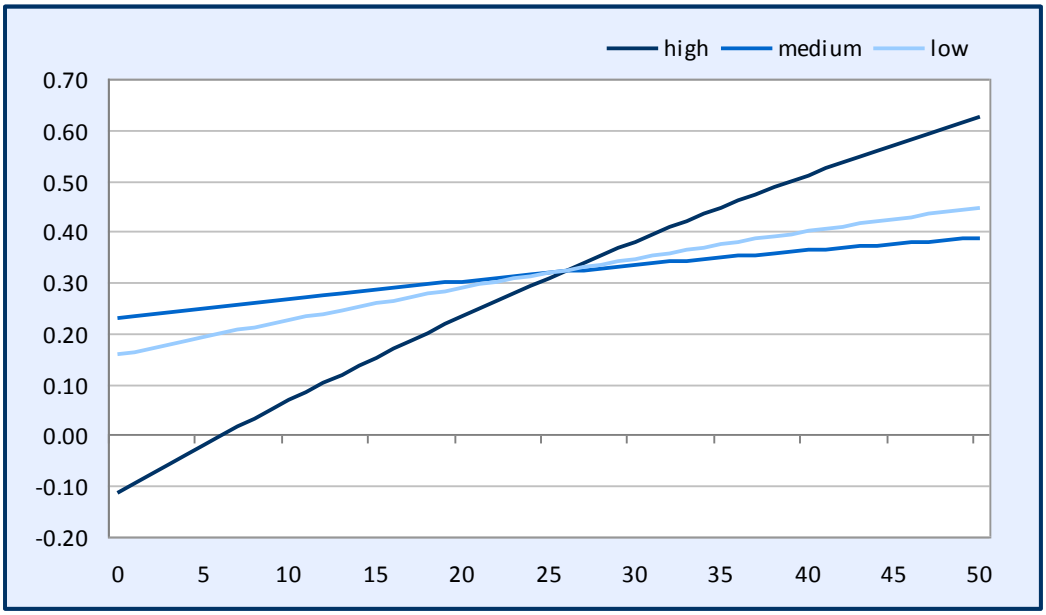
Figure 9 shows the combined training coefficients by number of training days for the high, medium and low use of HPWP sectors. The results suggest important differences, at least among the effects of training on satisfaction in sectors which have adopted the greatest levels of HPWP (high). In these sectors, at least six or seven days of training are required before training is viewed as adding to job satisfaction. It would take about 26 days before the overall effects of training in the high HPWP sectors overtake the medium and low sectors in terms of the impact on job satisfaction. Such a high number of training days is not observed for many individuals in the data, in any sectors, and it is unlikely to be offered by employers.

Table 18 **Training coefficient estimates for sectors grouped according to use of HPWP**

	High	Medium	Low
employer-provided training	-0.1140	0.22900*	0.15700
number of days training	0.0190***	0.00399	0.00713
training days-squared	-8.42e-05***	-1.66e-05	-2.65e-05

NB: See Table 17 for the grouping of sectors; * indicates statistical significance at 1% level; ** at 5% level; *** at 10% level.

Figure 9 **Combined coefficients for training, training days and days-squared by training days for high/medium/low HPWP sectors**



Sectors were put into two groups, low and high, according to the distribution of responses to the question about opportunities to learn and grow at work. Sectors in the low group had more than 50% of workers indicating that they strongly disagreed, disagreed, or neither agreed nor disagreed, that they had opportunities to learn and grow at work. High sectors were those in which more than 50% agreed or strongly agreed that they had opportunities to learn and grow. The sectors falling into each group is presented in Table 19.

The coefficient estimates for the employer-provided training variables for the high and low groups are set out in Table 20. The statistical significance of these three variables differs between the high and low groups. The indicator of whether or not employer-provided training was received by a worker was significant for the low group of sectors while the number of training days (and days-squared) was significant for the high group. In sectors where individuals are more inclined to agree that their job provides opportunities to learn and grow, the duration of training is most important while in sectors where there seems to be fewer such

opportunities, whether or not training is received is a more important factor than the duration of any training in determining job satisfaction. Again, the evidence suggests that the importance attached to being able to learn and develop at work is mediated through the provision of training, or the volume of training provided, if this is to be translated into improved levels of job satisfaction at sectoral level.

Table 19 **Sectors grouped according to high/low 'opportunities to learn and grow' at work**

High opportunities to learn and grow
Publishing, printing and reproduction of recorded media
Manufacture of electrical machinery or radio, television, etc.
Electricity, gas and water supply
Construction
Water transport; air transport; supporting transport activities
Financial intermediation; activities auxiliary to finance, etc.
Real estate activities and other business activities
Public administration and defence; compulsory social security
Education
Health and social work
Other community, social and personal activities
Low opportunities to learn and grow
Agriculture, hunting, forestry and fishing
Mining and quarrying
Manufacture of food/tobacco products
Manufacture of textile or leather products, etc.
Manufacture of wood or paper products
Manufacture of coke, refined petroleum, chemicals, plastics, etc.
Manufacture of metal products, machinery and equipment
Manufacture of transport equipment
Manufacture of furniture or recycling
Wholesale and retail trade; repair of motor vehicles
Hotels and restaurants
Land transport
Post and telecommunication
Private households with employed persons

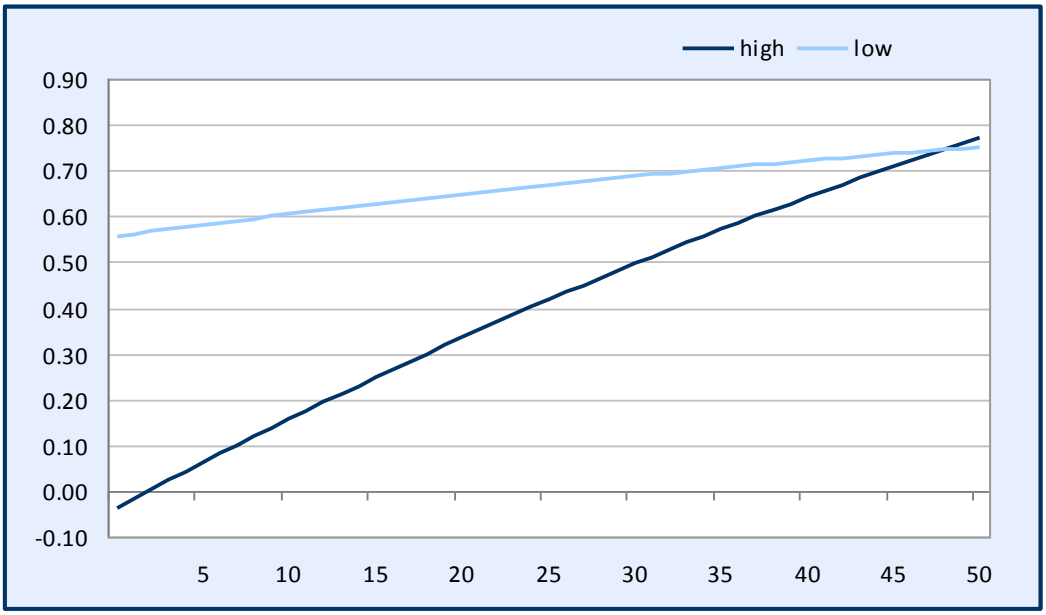
Table 20 Training coefficient estimates for sectors grouped according to 'opportunities to learn and grow' at work

	High	Low
employer-provided training	-0.0373	0.55600***
number of days training	0.0202***	0.00506
training days-squared	-8.05e-05***	-2.33e-05

NB: See Table 19 for the grouping of sectors; * indicates statistical significance at 1% level; ** at 5% level; *** at 10% level.

Figure 10 shows the combined coefficients by training days corresponding to the results in Table 20. The figure shows that at the receipt of training by itself, irrespective of days, results in a lower level of job satisfaction for sectors in which there are greater opportunities to learn and grow (high sectors) than in sectors with fewer opportunities, all else equal. Figure 11 shows that, based on all parameters in Table 20, it takes 48 days of training in sectors with high opportunities to learn to achieve the same effect of training given in the group of sectors with low opportunities to learn and grow (this interception of the two curves occurs at 28 days if only the significant coefficients from Table 20 are used).

Figure 10 **Combined coefficients for training, training days and days-squared by training days for high/low opportunities sectors**



It seems that individuals in the sectors with low opportunities to 'learn and grow' associate a high level of satisfaction from any length of training; training may be acting as a substitute for the low level of opportunities to 'learn and grow' (e.g. it is a different route to 'learning and growing'). In contrast, individuals in sectors with high levels of opportunity to 'learn and grow' may see little or nothing to be gained from short training courses; they may even interfere with their ability to gain satisfaction by 'learning and growing' within the firm. Longer training courses, however, may be more of a complementary activity to 'learning and growing' within the firm, adding to their already high levels of satisfaction from 'learning and growing' (i.e. they may be a new route to even higher levels of 'learning and growing').

To define high, medium, and low sectors according to skills mismatch, the proportions of workers within each sector who reported that they were under-skilled, skills-matched and over-skilled were calculated. 'High' sectors are those with the relatively highest proportions of under-skilled (i.e. their current skills are below the level required for their job). 'Low' sectors are those with the relatively highest proportions of over-skilled (i.e. individuals whose current skills are above what is required for their job). The remaining sectors are classed as having 'medium' skill needs.

This grouping of sectors says nothing about the absolute skill level of the individuals; they might be highly skilled but still not have sufficient skills for the job or have quite low skill levels but undertaking a menial task which does not fully utilise the skills they have (Section 4.3.3.2). The grouping is purely on the mismatch between the skills individuals have and those needed for their jobs. High skill need defines sectors that have relatively high proportions of individuals whose skills are insufficient for their jobs; medium skill need defines sectors with a relatively high match between the individuals' skills and those they need for their jobs; and the low skill need sectors are those with a relatively high proportion of individuals that report having higher levels of skills than those needed for their jobs.

The sectors falling into each group and the proportion of underskilled, overskilled and skill matched are summarised in Table 21. Manufacturing sectors (with the exception of manufacture of electrical machinery, etc.) appear in the medium and low skill need groups (i.e. the groups with relatively high degree of skills match and over-skilled, respectively). The degree of over-skilling is highest in those sectors categorised as having a low skill need. Dividing sectors according to skill needs is not straightforward and the divisions between high, medium and low needs are, ultimately, somewhat arbitrary. The results vary depending on the thresholds used to group sectors.

The estimated coefficients for the training variables in the ordered logit of the high, medium and low skill need groups are provided in Table 22. All three variables have statistical significance for the high skill need sectors (i.e. those sectors with a relatively high percentage of under-skilled workers). These coefficient estimates suggest that, in sectors where the proportion of workers who require additional training to perform their duties, training leads to a decrease of overall satisfaction, unless a certain number of days is provided. None of the variables shown are significant for low skill need sectors so that employer provided training has a negligible effect on job satisfaction in sectors where over-skilling is relatively high in the workforce (i.e. skill need is relatively low). In the

medium group, only the indicator of whether or not training was received, and not the days or days-squared, was found to be statistically significant.

Table 21 **Sectors grouped according to high/medium/low skill need**

High skill need
Manufacture of electrical machinery or radio, television, etc.
Financial intermediation; activities auxiliary to finance, etc.
Public administration and defence; compulsory social security
Education
Health and social work
Other community, social and personal activities
Medium skill need
Agriculture, hunting, forestry and fishing
Mining and quarrying
Manufacture of wood or paper products
Manufacture of coke, refined petroleum, chemicals, plastics, etc.
Manufacture of transport equipment
Manufacture of furniture or recycling
Electricity, gas and water supply
Construction
Land transport
Real estate activities and other business activities
Low skill need
Manufacture of food/tobacco products
Manufacture of textile or leather products, etc.
Publishing, printing and reproduction of recorded media
Manufacture of metal products, machinery and equipment
Wholesale and retail trade; repair of motor vehicles
Hotels and restaurants
Water transport; air transport; supporting transport activities
Post and telecommunication
Private households with employed persons; extra-territorial

Table 22 **Training coefficient estimates for sectors grouped according to skill need**

	High	**Medium**	**Low**
	Relatively high % under-skilled	**Mainly skills matched to job**	**Relatively high % over-skilled**
Employer-provided training	-0.2160**	0.34600**	0.0221
Number of days training	0.0119***	0.00756	0.0127
Training days-squared	-5.18e-05***	-7.82e-05	-3.08e-05

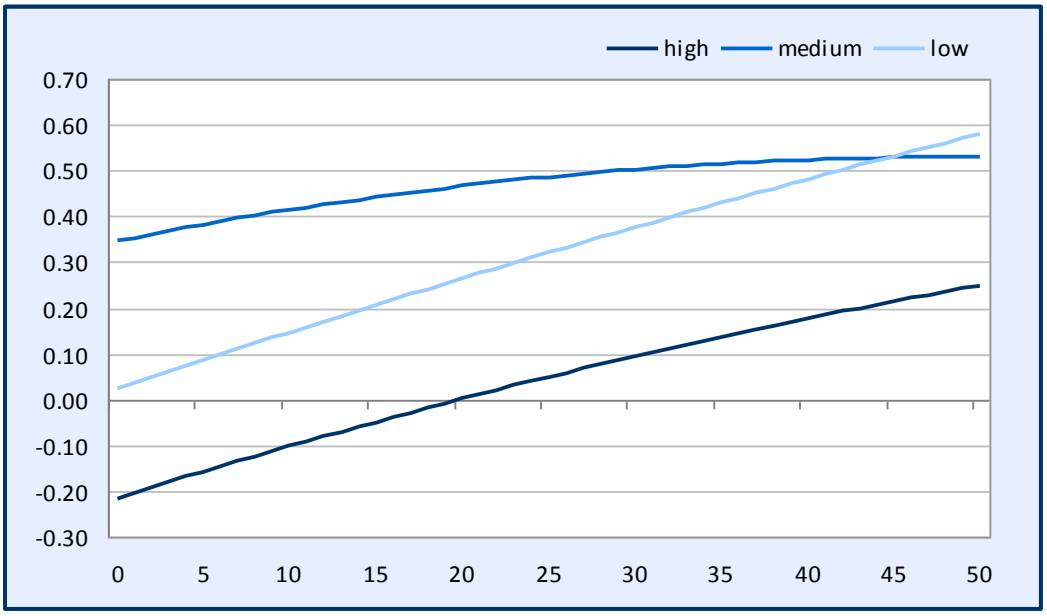
NB: See Table 21 for the grouping of sectors; * indicates statistical significance at 1% level; ** at 5% level; *** at 10% level.

Figure 11 shows the combined coefficients on training, days of training and days-squared by number of training days in high, medium and low skill need

sectors (as defined above). Training makes the highest contribution to job satisfaction in sectors where, overall, there is a greater match between workers' current skills and their jobs (medium need). The curve for medium need sectors is flatter than for high or low skill need sectors indicating that the number of days training received by individuals in medium need sectors does not make a large difference to their overall level of satisfaction with their job. It is likely that this is the group where the effects of 'gift exchange' will be greatest.

In sectors where skill needs are low and there is a relatively high proportion of workers with skills higher than needed for their current jobs, the provision of training still contributes positively to overall satisfaction, as long as the training course lasts for around five-six days; this increases with the number of days training, but only crosses the medium group at very high numbers of days of training. It would be counter-intuitive to expect over-skilled workers to get as much satisfaction from training as they already have more than sufficient skills for the job, unless perhaps the training opened up new and better job opportunities. In general, it might be expected that some reorganisation of their jobs, to use their skills more fully, would be a better 'gift'.

Figure 11 **Combined coefficients for training, training days and days-squared by training days for high/medium/low skill need sectors**



The interesting group are those with high skills needs relative to those demanded by their work. None of the training variables have significant coefficient for this group, although the pattern is similar to most results reported in this chapter. Training here is likely to be remedial and the need to attend a

training programme may have some stigma attached to it. However, the key outcome here is whether the training is sufficient to transform individuals from being under-skilled to having matching skills. This is more likely the longer the training programme and, if achieved, the effect of this on their satisfaction level is around 0.4 (Table 10).

Taking the proportions of individuals within each sector who responded to the question about the frequency with which their job involves them using their own ideas, the sectors were then grouped into high, medium and low categories. 'Low' sectors were those in which more than 25% of respondents indicated that they 'almost never' or 'rarely' used their own ideas on the job. 'High' sectors had more than 44% indicate that they 'always' used their own ideas. The remaining sectors were categorised as 'medium'. Table 23 indicates the groups to which the sectors belong. With the exception of the manufacture of electrical machinery or radio, television etc., all manufacturing sectors fall into the low category, indicating that there is a relatively low incidence of individuals using their own ideas on the job (more than 25% in these sectors 'almost never' or 'rarely' use their own ideas). The sectors characterised by the highest incidence of individuals using their own ideas on the job include: agriculture, hunting, forestry and fishing; real estate activities and other business activities; education; other community, social and personal activities; and private households with employed persons.

Table 23 **Sectors grouped according to high/medium/low 'ability to use own ideas' at work**

Low use of own ideas
Mining and quarrying
Manufacture of food/tobacco products
Manufacture of textile or leather products, etc.
Manufacture of wood or paper products
Manufacture of coke, refined petroleum, chemicals, plastics, etc.
Manufacture of metal products, machinery and equipment
Manufacture of transport equipment
Manufacture of furniture or recycling
Land transport
Post and telecommunication
Medium use of own ideas
Publishing, printing and reproduction of recorded media
Manufacture of electrical machinery or, radio, television, etc.
Electricity, gas and water supply
Construction
Wholesale and retail trade; repair of motor vehicles
Hotels and restaurants
Water transport; air transport; supporting transport activities
Financial intermediation; activities auxiliary to finance, etc.

Public administration and defence; compulsory social security
Health and social work
High use of own ideas
Agriculture, hunting, forestry and fishing
Real estate activities and other business activities
Education
Other community, social and personal activities
Private households with employed persons

The estimated coefficients for the training variables for each of these groups of sectors are provided in Table 24. For high and low sectors, the coefficient for the indicator of whether or not training is received is statistically significant, whereas the days of training (and days-squared) are significant in the medium group. The coefficient for whether or not training was received is positive for both high and low groups but is larger for the group of sectors in which the ability of workers to use their own ideas on the job is considered low.

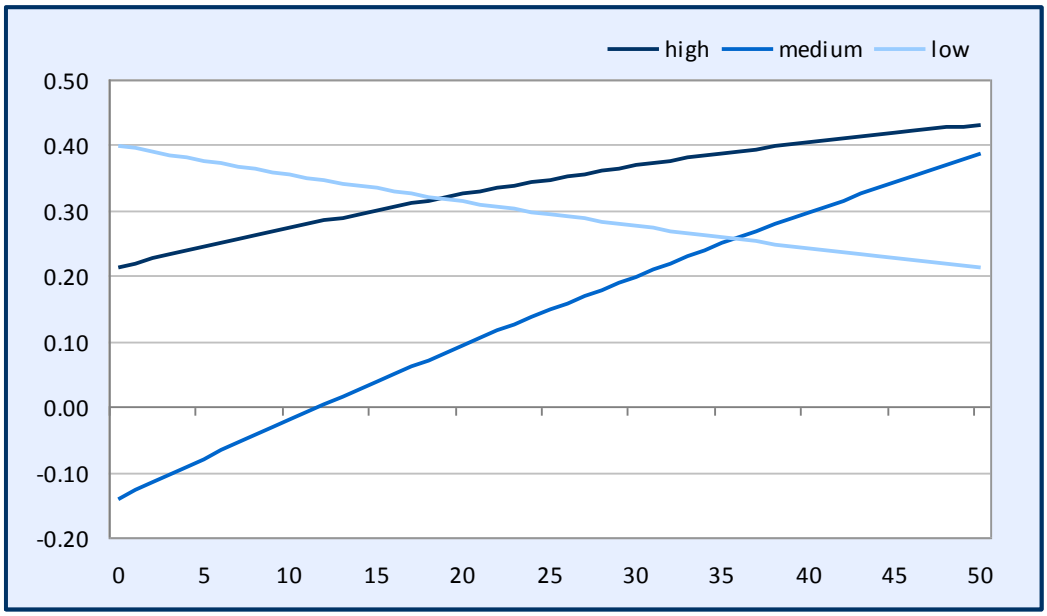
Table 24 **Training coefficient estimates for sectors grouped according to workers' use of own ideas on the job**

	High	Medium	Low
employer-provided training	0.21300*	-0.1410	0.39900***
number of days training	0.00639	0.0125**	-0.00465
training days-squared	-4.06e-05	-3.89e-05*	1.82e-05

NB: See Table 23 for the grouping of sectors; * indicates statistical significance at 1% level; ** at 5% level; *** at 10% level.

Figure 12 shows the combined coefficients for employer-provided training, the number of days of such training, and training days-squared. In those sectors where the use of individuals' own ideas on the job is relatively low, the impact of the binary indicator of training on job satisfaction is greater than in sectors with medium or high use of workers' own ideas (indicated by the vertical intercept). However, in the low sectors, job satisfaction decreases with the number of days of training provided by the employer. This may suggest that the provision of additional training makes a bad situation worse, with workers being delivered additional skills which employees might not choose to utilise. The associated firms might not only be places where workers are not encouraged to use their ideas, but also places without HPWPs and where the gift exchange model is not operational, so that additional training is perceived as an extra burden. For sectors in which there is relatively more use of people's own ideas in their day-to-day job (the 'medium' and 'high' sectors), satisfaction increases with the number of training days. Here training may well be contributing to workers being more readily able to use their own ideas and initiative in their job.

Figure 12 **Combined coefficients for training, training days and days-squared by training days for sectors with high/medium/low use of workers' own ideas**



4.4. Conclusions

Training, other things being equal, is able to increase the level of job satisfaction reported by workers. The effect of training is mediated through several HPWPs, such as the capacity to learn and grow at work or to use one's own ideas at work. The key issue is whether there is a sectoral effect: after controlling for the individual characteristics of workers and their workplaces, is there a residual sectoral effect or a set of sectoral interactions which suggest that there are activities or processes specific to certain sectors which affect the observed relationships?

The core findings from the study are that the following sectors appear to demonstrate a positive effect of training on job satisfaction over and above that which might be explained by the characteristics of their workforce:

(a) financial intermediation, etc.;
(b) manufacture of transport equipment;
(c) electricity, gas and water;
(d) mining and quarrying.

Generally these are a mix of high value-added sectors, ones requiring relatively high levels of skill input and, in the case of the latter two sectors, relatively high levels of health and safety regulation. These are also sectors which employ many people either directly or indirectly (e.g. financial intermediation, and manufacture of transport equipment), or are economically or

strategically important (e.g. electricity gas and water, and mining and quarrying). Results also show that either the same sectors, or similar types of sector, arise in the various analyses which attempt to isolate a sectoral effect with respect to training and job satisfaction.

Results also show, especially where sectors are grouped according to their level of high performance work practice, or the extent of workforce skills, that training is an important element in the overall bundle of practices associated with 'successful' sectors. These are sectors where human resource practices and the provision of training are mutually reinforcing in bringing about relatively high levels of job satisfaction. Again it is the usual mix of sectors which emerge: high skill, high value-added ones, those with a high level of safety regulation and, in some instances, the public sector.

A key question is whether training can transform the level of job satisfaction in the workforce; caution is advised. There is often a positive and significant coefficient attached to various sectors revealing some form of sectoral effect relating to the impact of training on job satisfaction, but, when investigating further the estimated volume of training (i.e. training days) required to transform a sector experiencing, other things being equal, a relatively low level of job satisfaction into one with high levels, the amount of additional training required is often unfeasibly large and suggests that such transformation is not possible. It needs to be emphasised that this applies to relatively few sectors. More generally, the results tend to reveal that job satisfaction within sectors can be improved at the margin by improving the provision of training alongside other factors which are also related to job satisfaction.

The idea of sectoral effect suggests that there is something in the modelling which fails to explain working arrangements or activities within that sector. With respect to training it may be that work structures allow people at sectoral level to develop their ideas and apply them in their jobs, and allow them to learn and develop at work, all supported by training of one form or another. This is explored more qualitatively in Chapter 6, but first an exploration is made of the relationship between training and productivity. If the quality of working life is to benefit from increased levels of job satisfaction resulting from training, this may only be sustainable if that training also brings improved productivity.

CHAPTER 5.

Training, job quality and productivity

5.1. Background

Although the effects of training and other skill development activities on productivity are really a private return for the employer, these returns have to be seen in the context of the 'gift exchange' model discussed in Chapter 3. There is an important symmetry here: the offer of better working conditions that improve individuals' level of job satisfaction will be most easily accommodated by the employer if it also improves organisational performance, whether through improved motivation and commitment or by some other route. An offer that improves working conditions, but reduces performance, is likely to be rejected by the employer; one that, potentially, improves performance but produces a deterioration in working conditions will be resisted by employees, undermining the benefits to the employer (see Chapter 7 for further discussion). A simple relationship between overall job satisfaction and productivity growth does not emerge from the results (the two are negatively related), and what we search for in this chapter are the positive influences on job satisfaction that also have a positive effect on performance.

The present study uses productivity performance as a proxy for the employer 'surplus'. The real employer surplus depends crucially on how the productivity gains, if any, are shared between the employer and employee in terms of increased profits and increased wages. Labour productivity is chosen because, there are currently no robust individual, group or other organisational performance measures that can be matched to the EWCS. Total factor productivity measures can be obtained at sectoral level, but they suffer problems in measuring capital input and in obtaining appropriate weights to aggregate the capital and labour inputs. Also, labour productivity measures are much more complete than total factor productivity measures in terms of numbers of years, sectors and countries for which they are available.

Section 5.2 continues with a more complete discussion of the data used in the productivity regressions, and the organisation of the econometric modelling. Section 5.3 discusses the main econometric results. Section 5.4 discusses the sectoral outcomes based on the coefficient estimates from Section 5.3. Finally, Section 5.5 provides the main conclusions of the productivity analysis.

5.2. Organisation of the econometric modelling

There are no viable individual or organisation level measures of performance in the EWCS, so the research team had to look elsewhere for variables that they could match to the data set. It was decided to use productivity data from the EU KLEMs database, mainly because it was constructed by highly experienced researchers, readily available, and the sectors available were closely aligned to the 25 sectors both used here and in the 2000-05 EWCS matched data set (Cedefop, 2011). However, future work might consider other data sets, such as the Eurofound employer survey.

One problem with the EU KLEMs sectors is that land and other forms of transport were aggregated in a single category, whereas in the EWCS data it is disaggregated into 'land transport' and 'water transport; air transport; supporting transport activity'. As the current research has no straightforward way of undertaking a disaggregation, it therefore assumes that the KLEMs measures for the more aggregate sector can be the same for each of the two EWCS sectors. Aggregation from the KLEMs sectors to the EWCS necessary to reconcile the two data sets was either a simple total (e.g. in the case of value added or employment) or a weighted average (e.g. in the case of value added prices, where shares in value added were the weights).

Complete KLEMs data are available for 25 countries (out of the 31 available in EWCS) over the period 1995-2007 ([19]). The following variables were constructed for the present project:

(a) VA-EMP is value added (m euros) per engaged individual (including self-employed) current prices;

(b) VA_P (value added prices) has been corrected by weighting the indices to be summed by the relative value added in 1995 (the base year =100) ([20]).

These productivity level values were then transformed into total percentage changes over five-year periods. The results presented below relate to changes calculated over the period 2004-07. The rationale for the choice was as follows: first, there is a lot of 'noise' in the short period variations in productivity (hence the choice of a five-year period, rather year-on-year changes or other variants);

([19]) KLEMs data go back as far as 1970 for some countries, but not for others (e.g. the new Member States). In addition, certain variables are only available to 2005, but the ones used here are available through to 2007.

([20]) Other variables have been constructed and will be used in future work (e.g. VA-EMPE is value added (m euros) per employee current prices; VA-H_EMP is value added (m euros) per engaged individual hour (including self-employed) current prices; VA-H_EMPE is value added (m euros) per employee hour current prices).

second, our preference was for productivity change that largely post-dated the EWCS, 2005 (hence the choice of 2004-07, which is the latest five-year period available) ([21]). The same was also done to construct the change in value added prices. Rather than adjust from current to constant price productivity change measures, the growth in productivity is regressed upon the growth in value added prices, as well as all the other working conditions and control variables.

A sequential approach was again applied, very similar to that carried out for job satisfaction.

5.3. Econometric results

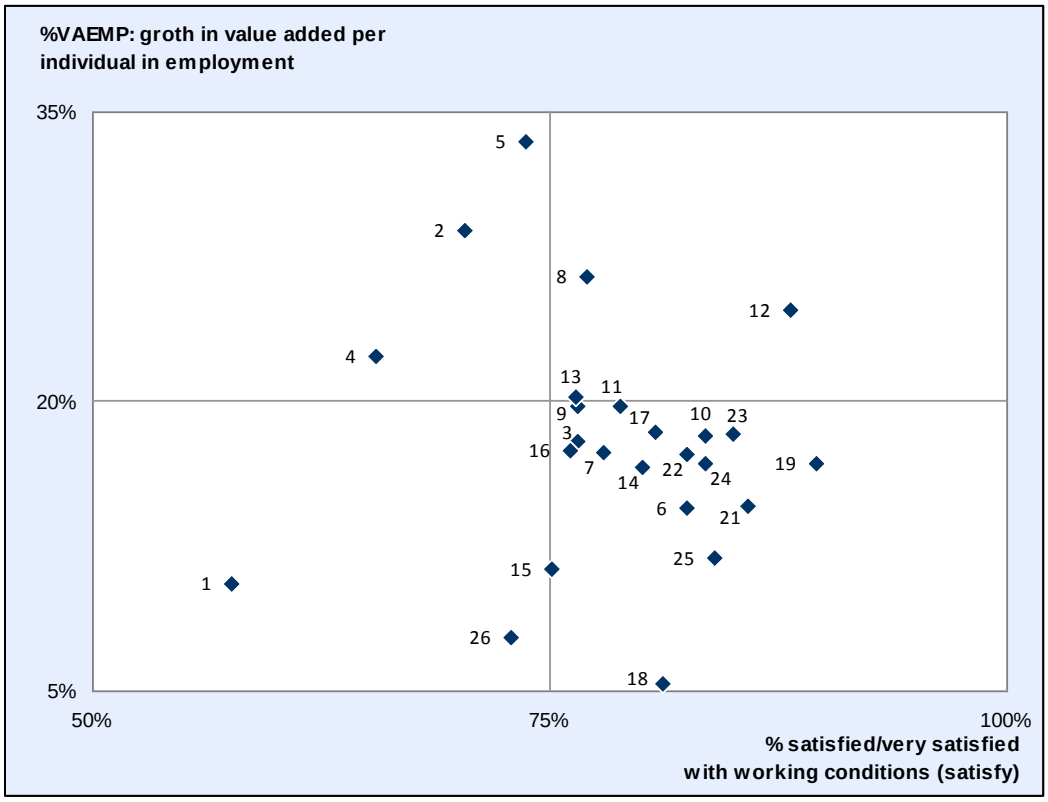
5.3.1. Results for value added per head

5.3.1.1. *Job satisfaction*

The most obvious specification to try is productivity growth regressed on job satisfaction, skill development variables and other control variables. Conceptual literature (Chapter 3) suggested that the relationship should be positive, if the 'gift exchange' hypothesis is working. Figure 13 sets out the scatter diagram for the relationship between the growth in value added per individual in employment (e.g. all workers whether employed or self-employed) and the proportion of individuals reporting to be satisfied or very satisfied with their working conditions. No immediate relationship can be seen and, if anything, a negative relationship seems as likely as a positive one. Unless controlling for other influences on productivity growth result in a change in this relationship, a more nuanced view of the 'gift exchange' relationship will be needed.

([21]) Ideally productivity change data that completely post-dated the EWCS would have been preferred, but no comprehensive and consistent source for such data has been located.

Figure 13 **Growth in value added per individual in employment (2004-07) and job satisfaction by sector**



NB: For sectors labels see Box 2.

The next step is to move to regression analysis. Here the independent variable is formed from the four categories which reflect the ranking of individuals' satisfaction. When productivity growth is regressed on job satisfaction alone (controlling just for prices), the sign is negative and the relationship monotonically increases in absolute terms as satisfaction rises, with the satisfied and very satisfied coefficients significant at the 5% level or higher ([22]). Inclusion of the other skill development variables and the further inclusion of the control variables both leave the coefficients negative, but also insignificantly different to the base group throughout.

While, at first sight, this may appear disappointing, it was perhaps too much to expect that all dimensions of 'good' working conditions, or even most of them, would give rise to higher productivity. Hence, the study proceeds by exploring

([22]) E.g. 'not very satisfied' has a coefficient of -0.602 (*vis-à-vis* the base of 'not at all satisfied'), 'satisfied' has a coefficient of -1.042 (significantly different from the base at the 5% level) and 'very satisfied' has a coefficient of -1.453 (significantly different from the base at the 1% level).

whether some dimensions of working conditions — in particular, among the skill development variables — have positive effects on both satisfaction and productivity.

5.3.1.2. *Skill development*

Table 25 sets out the main productivity results for the final three regressions from the sequential approach ([23]). Estimates in column 1 include all of the skill development variables. Those in column 2 also include the factor scores for the unsocial working condition variables. Estimates in column 3 also contain the raft of control variables. For simplicity, only the results for value added per worker are given; 'worker' again implies all individuals in employment, including the self-employed. The acronyms used in Table 25 are defined in Table 9.

As in some of the earlier results, neither of these findings is too surprising; they are typical of what happens in many econometric studies, where potentially relevant variables are added to the specification at a later stage. While there is a preference for including all of the controls, the focus here is on the results in columns 1 and 2, as well as some of the changes in the sequential introduction of the 'skill development' variables ([24]).

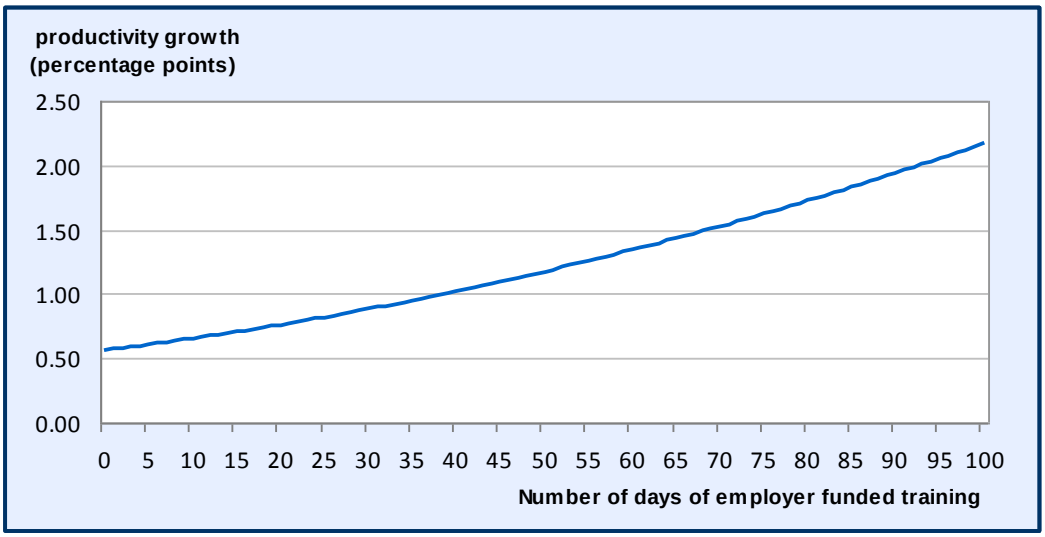
Employer-funded training (tremp) has a positive and significant coefficient in columns 1 and 2. Figure 14 shows an almost linear relationship, with low levels of training associated with a 0.5 of a percentage point increase in the growth of productivity over the period 2004 to 2007. The size of this change increases with the number of days, rising to about 1 percentage point in the rate of growth in productivity by around 40 days ([25]). This is an important result which is robust throughout the sequence of estimates, at least until those in column 3 (Table 25), which includes many control variables.

([23]) Many regressions were undertaken: only those revealing the best fit with the data are reported. Further information is available from the authors.

([24]) While education is not included in the skills development variable set, it is worth reporting at least in this footnote as there is a distinct inverse 'u-shaped' relationship in the coefficients across levels. In fact, edlevel1 — the lowest level of formal qualification — has a negative coefficient throughout, although it is never significantly different from zero. The coefficient size then rises through to education level 3 and, particularly, 3a, before falling away again. It is interesting that the highest growth in labour productivity is associated with edlevel3a, which is 'post-secondary including pre-vocational or vocational education'.

([25]) A simple arithmetic average across all sectors and countries for which data are available suggested that the overall five year improvement in labour productivity was about 18%.

Figure 14 **Percentage point change in value added per person growth, 2004-07**



None of the coefficients on employee-funded training are significantly different from zero (tremploy, tremploy_ds and tremploy_d2): this variable is left for future exploration and not discussed further here. However, both on-the-job and other on-the-site training have significant positive coefficients; onjobtrain has a coefficient of about 0.75-0.85 and onsiteoth has a coefficient of about 0.65-0.75 (except in the regression with all the control variables, column 3). These suggest that on-site and on-the-job training may make important contributions to the growth in labour productivity for those that receive them. The edleave variable (educational leave) appears more associated with individuals' development outside of the firm and carries an insignificant negative sign throughout (except column 3, where it is insignificant positive).

There is tentative evidence that more complex jobs (complex) are associated with higher changes in productivity. However, the associated coefficient becomes insignificantly different from zero in the penultimate column, suggesting that something in the factor score reflecting unsocial working conditions is picking up this influence more strongly. Also, jobs involving the need for problem solving (solveprob) are associated with significantly lower changes in productivity (even the coefficient in column 3 is significantly different from zero).

Quite strong evidence indicates a link between intellectual demands of the job and higher productivity growth. Until the final regression with all the control variables, there is a monotonic increase in the coefficient size and increases in significance levels from the 'never intellectually demanding' to the 'always intellectually demanding'. The highest two levels of intellectual demand are always significant at the 10% level or higher except in the final column. The

coefficients on the degree to which employees use their own ideas have exactly the opposite pattern: they are negative and increase in absolute size with the extent to which the individuals use their own ideas and significant in the three most intensive use categories (again, with the exception of column 3).

Table 25 **Percentage change in value added per head (ordinary least squares), all workers, 2004-07**

	1	2	3
tremp	0.558**	0.563**	0.054
tremp_ds	0.008	0.009	0.006
tremp_d2	8.19e-05	7.68e-05	3.16e-05
tremploy	-0.059	0.070	-0.451
tremploy_ds	-0.002	-0.006	-0.004
tremploy_d2	1.59e-05	2.67e-05	2.79e-06
onjobtrain	0.857***	0.754***	-0.310
onsiteoth	0.671**	0.735**	0.031
edleave	-0.395	-0.384	0.082
complex	0.463**	0.243	-0.137
solveprob	-1.363***	-1.182***	-0.472**
intelldemand_rare	0.664*	0.745**	0.816***
intelldemand_some	0.226	0.311	0.289
intelldemand_often	0.859***	0.954***	0.650**
intelldemand_always	1.241***	1.373***	0.272
ownidea_rare	-0.394	-0.400	-0.231
ownidea_some	-0.878**	-0.729*	-0.100
ownidea_often	-1.332***	-1.096***	-0.085
ownidea_always	-1.166***	-0.845**	0.044
yrsco	-0.003	-0.013	0.012
lrn_new	0.260	0.201	0.168
opp_disagree	1.252***	1.305***	0.564*
opp_neutral	-0.367	-0.241	-0.221
opp_agree	-0.928**	-0.678*	-0.265
opp_strong agree	-1.026**	-0.687	0.007
rotatenew	0.363	0.114	-0.039
skillunder	-0.400	-0.381	-0.198
skillover	0.501**	0.487**	-0.00134

NB: The acronyms used here are defined in Table 9 and in the text.

The experience and learning variables also have some unexpected and significant coefficients. Years with the company (yrsco) is negative, but insignificant throughout (the learning hypothesis put forward in Chapter 4 would suggest a positive coefficient). While the ‘learning new things’ variable is mainly positive, it also has insignificant coefficients throughout. The ‘opportunity to learn and grow’ variable, however, has exactly the opposite pattern to that found in the satisfaction regressions. The greater the extent to which employees can ‘learn

and grow' in their job, the lower the associated sectoral change in productivity growth.

The final group of skill development variables include rotatenew, which, while generally positive, is only significant in column 13 (and not in the results shown in Table 25). Having skills which are not sufficient for the job (skillunder) has a negative impact on productivity growth, but not significantly different from the base group (skills match the needs of the job). However, those who report more skills than necessary for the job (skillover) are linked to sectors with a significantly higher change in productivity than the base group.

5.4. Sectoral dimension

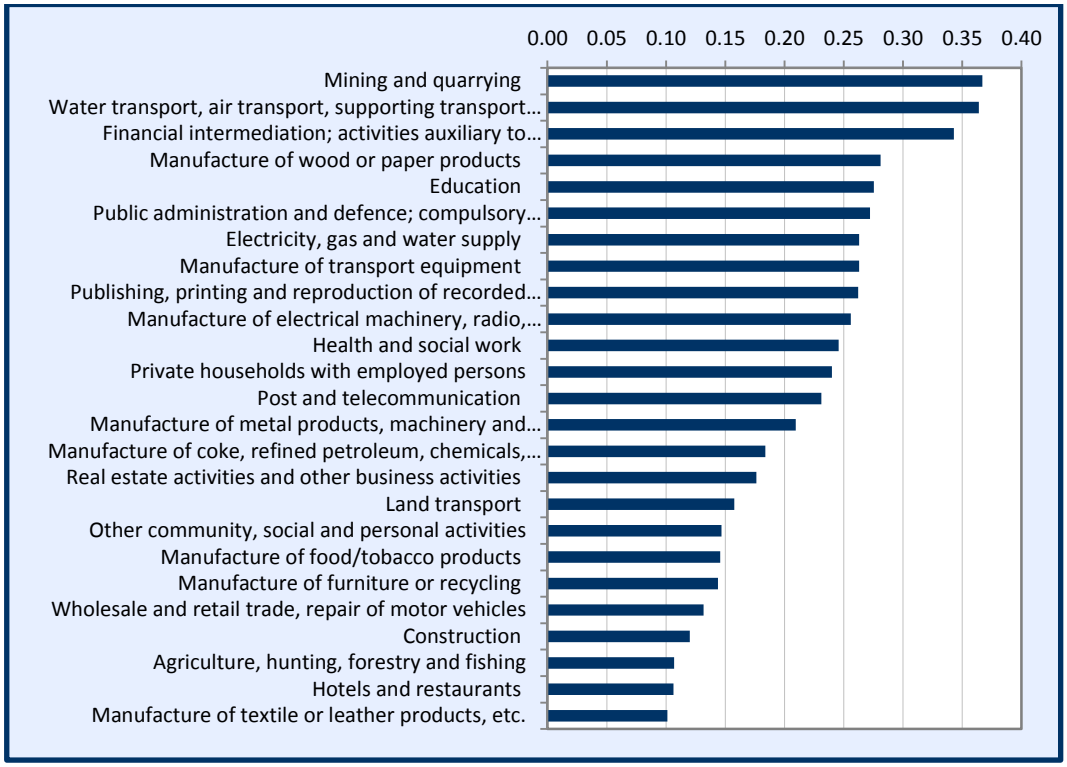
5.4.1. Organisation of the sectoral results

The sectoral results here correspond with those in Section 4.3.4-4.3.6. They report on the impacts of training at sectoral level. The results are formed by multiplying the relevant estimated coefficients (marginal effects) of each of the variables by the corresponding sector means of the amount of training carried out in each sector. Using sectoral averages of the levels of each variable tends to reduce the degree of variation in the data and, in the case of training - which had a reasonably large coefficient size and, hence, marginal effect - the presence of quite high proportions of individuals not receiving training and low training days, make the resulting effects quite small.

5.4.2. Training and productivity growth

The sectoral impact of employer-funded training on productivity growth across all 31 countries is shown in Figure 15. These results are averages across the 31 countries of the estimated training coefficients (e.g. the coefficients on tremp, tremp_ds and tremp_d2) in the productivity regression, multiplied by the mean incidence of training, mean number of training days and mean number of training days squared respectively, in each sector. Figure 15 only includes sectors with non-zero values of training activity in each country; private household employment has a significantly smaller number of workers reporting training than most other sectors. The argument for using this measure, excluding non-zeros, is that it does not penalise the average for sectors which are effectively absent in some countries.

Figure 15 **Impact of training on productivity growth (non-zero training sectors)**



While, the correlation between the average coefficients using only non-zero values and using all values (including zeros) is fairly high (R2=0.58, F=34.0***) ([26]), it makes some differences to the rankings (although the Spearman correlation between the two ranks is 0.81). The principal differences in the rankings are in private household employment, manufacture of wood and paper products, and mining and quarrying (principally the first of these three). The rationale for using this measure (including zeros) is that it does not overly favour sectors that do no training. The results are shown in Figure 16.

Ignoring the three sectors which are the principal points of difference between the two measures, the following sectors are among those for which training makes the highest contribution to productivity growth:

(a) water transport; air transport; etc. (ranked 2, non-zero training sectors, 1 training sectors, respectively);

(b) financial intermediation (ranked 3, 2);

(c) education (ranked 5, 3);

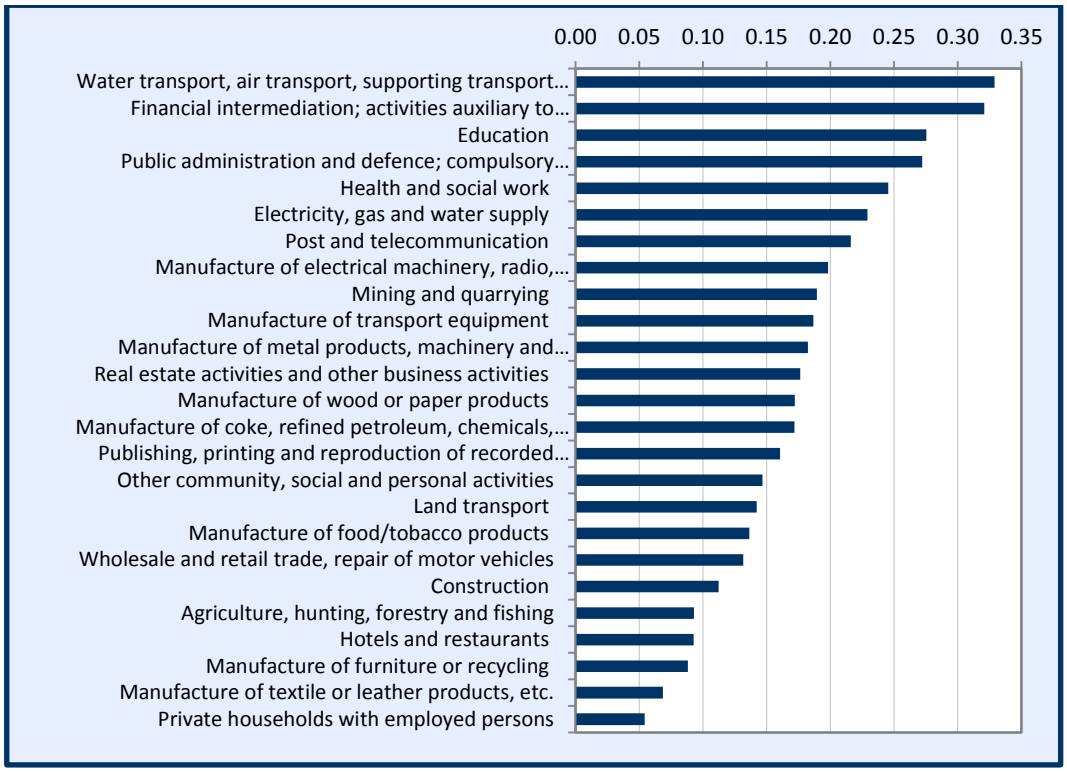
([26]) The intercept is close to zero, but significantly different from zero at the 5% level, while the slope is reasonably close to unity (0.84) and not significantly different from unity.

(d) public administration (ranked 6, 4);

Again, ignoring the problem sectors, those ranked most lowly by both measures include:

(a) manufacture of textiles, etc. (ranked 25, 24);
(b) hotels and restaurants (ranked 24, 22);
(c) agriculture, etc. (ranked 23, 21);
(d) manufacture of furniture or recycling (ranked 20, 23).

Figure 16 **Impact of training on productivity growth (all sectors)**



5.4.3. Comparison of the sectoral contributions of training to productivity growth and job satisfaction

The 'gift exchange' model suggests that there should be a link between the sectoral effects of training on job satisfaction and on productivity growth. The present section carries out a simple test of whether:

(a) the size of the 'gift' (from employer to employee) in terms of the sectoral contribution to job satisfaction is linearly related to the size of the 'gift' (from the employee to the employer) in terms of increased productivity;

(b) the ranking of sectors according to the effects of training on job satisfaction is correlated with the ranking of sectors in terms of the effects of training on productivity growth.

Is there any correlation between the sectoral outcomes described in Chapter 4 and those described earlier in Chapter 5?

Such an outcome is expected for several reasons:

(a) the satisfaction-productivity 'gift exchange' is only one factor influencing productivity performance;
(b) the outcomes described to date are broadly based averages for each sector, but across outcomes for 31 countries.

The results of regressing the contribution of training to productivity growth on the contribution of training to increasing satisfaction (OLS) across sectors suggest that this pessimism of finding a link may be well founded. A simple linear regression results in an intercept of 0.21*** and slope of close to unity (0.92, insignificant at the 10% level). However the R2 and F statistics are both low, and the F statistic is not significant at the 10% level.

Applying a Spearman rank correlation test reveals a more positive outcome. The Spearman result gives a rank correlation of 0.33 between the ordering of the sectors in terms of training contribution to productivity and job satisfaction. However, the results also suggest that very few sectors reduce the correlation significantly, in particular:

(a) agriculture (with a difference in rank of 19);
(b) manufacture of food, etc. (difference in rank of 18).

In the absence of these two, the rank correlation rises from 0.33 to 0.55.

Removal of these two outliers also has a major impact on the OLS results, suggesting a much more positive outcome for the 'gift exchange' hypothesis. The results are as follows:

prod = 0.2015*** + 3.0802*** x job satisf with R2= 0.44 and F=16.76***.

Here, prod represents the effects of training on productivity growth and train represents the effects of training on job satisfaction. This appears to be a strong result, linking training with productivity performance, at least if the two sectors omitted are special cases. The results appear to be consistent with the 'gift exchange' framework outlined in Chapter 3. This suggests that employers who can offer sufficient training days to ensure that workers obtain positive satisfaction from their training are likely to reap the benefits of higher commitment and motivation, as well as the higher skills, in terms of increased labour productivity.

5.5. Conclusions

The productivity results were unexpectedly strong, given that the dependent variable is a growth measure rather than a level. Productivity change is used as a proxy for the improvement to employer surplus, although the extent of the surplus they receive depends on how much is absorbed in the form of higher wages rather than higher profits.

The EU KLEMs data were organised according to the 25 sector groups adopted in the EWCS database and manipulated to give the rates of change in value added per person, including the self-employed. They were then matched to EWCS by sector, giving a maximum of 625 sectoral observations of productivity growth between 2004 and 2007. While it would have been best if the whole of the productivity change period fell after 2005, the latest KLEMs data released were for 2007. Though including all the controls unsurprisingly 'washed away' the skill development results, the earlier regressions without the controls gave interesting and plausible results.

Employer-provided training showed through positive and highly significant; although neither the number of training days or training days squared coefficients were significantly different from zero, they were positive. The positive coefficient estimated was small taking the effect on productivity growth from about 0.5 percentage points at low levels of training up to about 1 percentage point after 40 days of training. On-the-job training and other on-the-site training also had positive effects on productivity growth performance.

Iin the context of the 'gift exchange' model, improvements in some dimensions of working conditions benefit both the worker and the employer; it is important to know whether the sign on each working condition variable is the same in both the satisfaction and productivity regressions (see Section 3.4, in particular Table 1 for a discussion). This is the 'preferred' outcome where, in effect, both parties benefit from increases (or reductions, depending on the sign) in the various working conditions variables, and particularly so where the associated coefficients are significantly different from zero. Second best occurs where the effect for one of the two parties is positive and significant on either productivity growth or satisfaction levels and is insignificantly different from zero for the other party. The worst outcome is where the signs are opposite and significant between workers and employers.

Employer-funded training plays a positive and significant role in both regressions, as long as the number of days of training is sufficient, if there is a negative intercept on the quadratic specification. The implication is that, in sectors where the tremp coefficient in the satisfaction regression is negative, but the slope coefficient is positive (tremp_ds) the employer should consider

sufficiently long periods of training to take the satisfaction level positive, consistent with the fact that the return on training in terms of productivity growth is positive and increasing at the margin.

On the job training (onjobtrain) and other on-site training (onsiteoth) both carry positive and significant coefficients in the productivity regressions, but other on the site training carries a significant negative coefficient in the satisfaction regressions. While employers would take a positive view about both forms of training, employees are likely to be resistant to other on-site training, but, consistently with employers, positive about on the job training.

This chapter has considered the actual impacts of the principal independent variable (training) on productivity growth in each of the sectors. Among the sectors that benefitted most were: water transport, air transport; etc.; financial intermediation; education; and public administration. Among the sectors that benefitted least were: manufacture of textiles, etc.; hotels and restaurants; agriculture, etc.; manufacture of furniture or recycling.

The discussion addressed the issue of whether training might be the focus of 'gift exchange'. This was carried out at a broad sectoral level (across all 31 countries combined) to see if the contributions of training to satisfaction were largest in the sectors where the contribution of training to productivity were also largest. While an initial linear regression suggested only the most tenuous of links, the Spearman coefficient suggested a rank correlation among sectors of about 0.33. Further investigation of the rankings indicated that two sectors in particular appeared to be outliers (agriculture, etc., and manufacture of food, etc.); removing just these two sectors results in a rank correlation of around 0.5.

Table 26 shows that four of the nine highest ranked sectors for the contribution of training to satisfaction have almost identical rankings in terms of the contribution of training to productivity:

Table 26 **Ranking of selected sectors according to the contribution of training to productivity and job satisfaction**

	Rank	
	Productivity	**Satisfaction**
Mining and quarrying	1	1
Water transport; air transport; etc.	2	2
Public administration and defence; etc.	6	5
Health and social work	11	9

NB: Results computed in the absence of the two outlier sectors.

This appears to support the ‘gift exchange’ hypothesis in the case of training, suggesting that employers who can offer sufficient lengths of training to ensure that workers obtain positive satisfaction from their training will reap the benefits through higher commitment and motivation, as well as the higher skills, in terms of increased labour productivity.

CHAPTER 6.

Education and training and job quality: sectoral studies

6.1. Introduction

The preceding chapters have shown the extent to which there is a quantitative relationship between the quality of work (however defined) and the provision of training at sectoral level. In the theoretical model summarised in Chapter 3, social benefits are defined with respect to training being part of the social contract which results in a win-win situation for the employer and the employee: the mix of relatively good working conditions, including training and development, benefits the employer through increasing workplace productivity, and the employee benefits through relative wage gains, better job stability, and a more satisfying work environment. At an aggregate level there are potential sectoral gains depending upon the extent to which working practices are interrelated within sectors and among them. This may result from:

(a) mimetic behaviour, where one employer observes another doing well they may be inclined to copy working practices which they consider to be related to relatively good organisational performance;
(b) the social norms which have been established in a sector or region over a period of time;
(c) the extent to which technology shapes working practices;
(d) the synergies which can be achieved within value chains.

While the quantitative analysis is able to shed much light on the extent to which there are statistically significant results at individual employee or workplace level, and in aggregate at sector level, there is a need for more detailed, qualitative investigations which can begin to shed light on the causal relationships at, in this case, sectoral level within geographic clusters.

The aim of the sector studies presented in this chapter is to show how training investments not only support the development of a high quality work environment, but also contribute to the reallocation of labour towards more productive and more competitive workplaces within the sector. The analysis leaves the micro-based perspective behind in favour of a sectoral one, nested within geographic clusters, which puts the quality of labour market segments into focus. We want to know how and why regional specialisation in goods or services emerged and how much of that can be attributed to training investments and,

more generally, HPWPs which emphasise job quality. Of interest is not only the extent to which the social contract between employees and employers supports workplace productivity, but also how networks of employers, employees, policy-makers and training institutions contribute to the restructuring of a sector and its growth. This cooperative model contrasts with a liberal labour market model without such alliances.

6.2. Selection of sectors and regions

When looking in detail at how training becomes part of the alliances at sectoral and regional level there is a need to select cases which vary with respect to their production processes, their skill requirements, and their labour market constitution. For training as part of restructuring, there is also a need to incorporate both mature sectors and those which are still in the relatively early stages of development. Table 27 provides some sectors which fit these criteria.

Table 27 **Selection of case studies**

Sector/cluster	Development stage of sector	Skill needs	Maturity of sector	Degree of cooperation
Medical technologies/ Baden-Württemberg	Part of a mature sector (instrument engineering); considerable growth potential with development of new treatment technologies	Highly specialised production processes with high precision and quality requirements; small scale production	Medium	High
Textiles/ Flanders	Restructuring sector which concentrates on technical textiles	High technology solutions based on the development of new materials and new processes. High level of skill demand	High	Medium
Wind power engineering/ Jutland	A strongly growing sector with high innovation rates	High skills demand for R&D and production; gradually transforming to large scale production	Low	Medium
Financial intermediation/ City of London	A highly specialised regional cluster with strong competition	High skill and well paid; considerable in- and outflows in labour market	Low	Low
Hi-tech manufacturing/ south east Brabant	Model cluster for the restructuring of manufacturing towards high-tech services and value chain management	Increasingly high skilled workforce with a substantial R&D component; decreasing demand for production oriented skills	Medium	High

Table 28 shows the levels of job satisfaction, training incidence, and job quality indicators in the sectors from which the sector studies are drawn. The job quality indicators are based on the extent to which employees report that they are subject to, at least some, hazardous work conditions, physically arduous tasks, and shift working.

Table 28 **Job satisfaction, job quality and the incidence of training in study sectors**

	Yes, received training	% satisfied with job	Average number of items experienced more than 'almost never' as % of all survey items			Sector case study reference
			hazardous environment (10 items)	physical tasks (13 items)	shifts and times (5 items)	
Agriculture, hunting, forestry and fishing	8	58	28	37	53	
Mining and quarrying	36	70	31	37	47	
Manufacture of food/tobacco products	20	77	20	38	39	
Manufacture of textile or leather products	8	66	22	32	29	Textiles
Manufacture of wood or paper products	21	74	32	41	36	
Publishing, printing and reproduction of printed media	21	82	18	39	35	
Manufacture of coke, refined petroleum	31	78	28	40	37	
Manufacture of metal products, machinery	25	77	30	40	33	Brainport
Manufacture of electrical machinery or instruments	37	77	19	39	36	Baden Württem-berg
Manufacture of transport equipment	33	84	32	39	33	
Manufacture of furniture or recycling	15	79	30	40	30	
Electricity, gas and water supply	36	88	23	41	34	Green sector
Construction	17	76	35	44	32	
Wholesale and retail trade; repair of motor vehicles	20	80	13	39	37	
Hotels and restaurants	12	75	17	38	60	
Land transport	24	76	21	36	53	
Water transport; air transport; supporting activities	34	81	23	39	52	
Post and telecommunication	36	81	10	40	28	
Financial intermediation; activities auxiliary to finance	49	90	4	39	23	City of London
Real estate activities	32	86	9	42	35	
Public administration and defence; computing	43	82	13	39	33	
Education	43	85	10	40	23	
Health and social work	43	83	15	45	44	
Other community, social and personal activities	25	84	16	39	38	
Private households with employed persons	10	73	10	33	27	

Source: ECWS, 2005

Based on the information in Table 28 it is possible to outline where each of the sectors, from which the case studies were drawn, are situated with respect to job quality and the incidence of training (Table 29). This does not necessarily mean that the levels of job satisfaction and training prevail in the sector studies; the ability of the sector studies outlined in Table 27 to maintain relatively high levels of high-skill, high-value employment is predicated in most instances on being able to maintain high levels of human capital development allied to human resource policies which retain employees, if not within specific workplaces then certainly within clusters of activity. It is this mix of practices which allows effective cooperation among companies. As can be seen from Table 29, the studies are in sectors which reveal differing levels of job satisfaction and training activity.

Table 29 **Characteristics of the sectors in which the sector case studies are situated**

Training incidence	Job quality		
	Relatively high	Medium	Relatively low
Relatively high	Financial services (c.f. City of London) Green sector	Medical technologies (c.f. Baden Württemberg)	
Medium	Hi-tech manufacturing (c.f. Brainport)		
Relatively low			Textiles (c.f. Flanders)

NB: The sectors shaded blue indicate relatively high levels of job satisfaction; those shaded pink indicate relatively low levels of job satisfaction.

The study has sought to identify the role of training investments, within the wider context of economic restructuring, employment growth and job quality. This implies — almost by nature — different stages of a sector's lifecycle, and it brings public institutions and the training sector into the focus of the analysis.

Figure 17 shows a relatively simple interpretation of the development path of sectors from the early stages, where organisations within a sector are likely to be small with employees fulfilling several roles (multi-skilling/multi-tasking) within a work environment which is relatively informal. As the sector matures, and there is a degree of consolidation among companies, organisations grow in size with more formal work structures developed with less scope for multi-skilling or multi-tasking. As the sector develops, and the products become commodified with concomitant systems of production (e.g. systems of mass production requiring relatively low level machine-minding skills from operatives), it is likely that much employment can be exported to low labour cost countries. What is left is often a rump of highly-skilled, knowledge-intensive activities which concentrate on high

value-added aspects. This has the potential to spin-off new activities in new sectors or sub-sectors.

Figure 17 **Development stage of sectors and resulting skill needs**

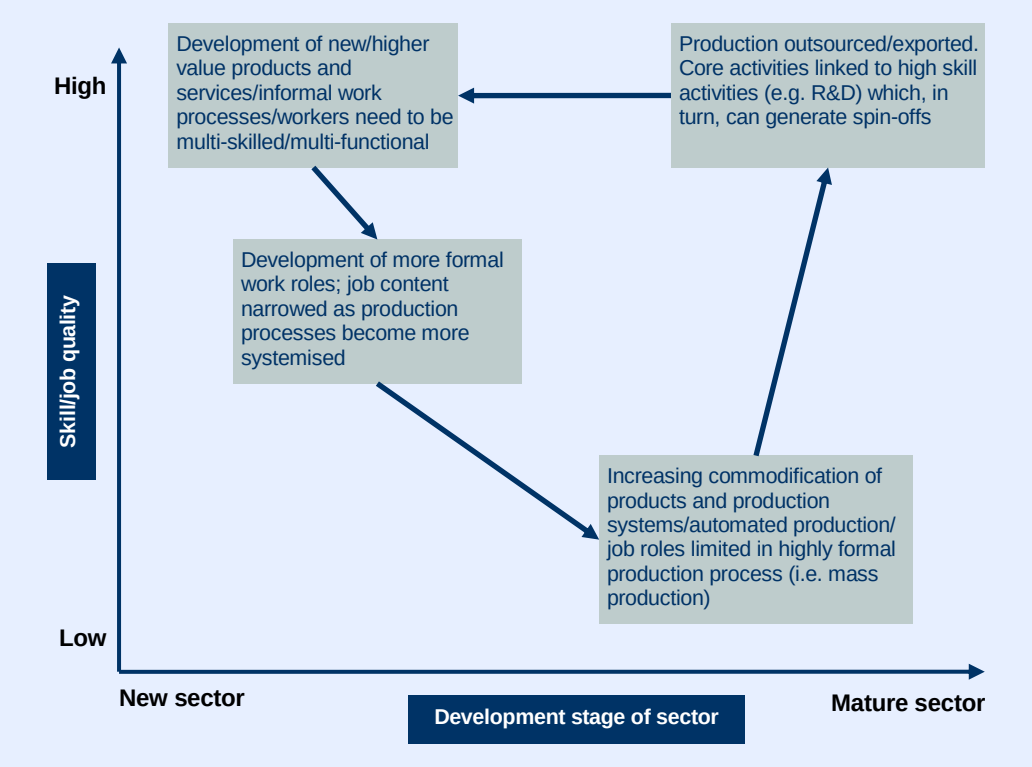


Figure 17 is overly deterministic and suggests that little free choice is exercised by employers within any given sector. It is apparent from the previous study that some employers, and possibly entire sectors, are able to buck this trend (Cedefop, 2011). The sector case studies provided below explore how such changes are achieved at aggregate level and which role is addressed to training in this context. Two particular issues are explored: the extent to which sectoral and regional development depends on the supply of an adequately and highly skilled workforce; and the extent to which patterns of networking, especially geographic clustering, contribute to restructuring and economic performance.

6.3. The sectoral social contract

Social contract means the nature of the typical, sector-wide employment relationship between the employer and the employee which exists either at national level or within a specific locality. The social contract may be codified in

collective agreements but it is more likely to exist in a tacit form between employers and employees. For example, in some firms in the accountancy sector there is an implicit understanding between employers and employees that the latter will have access to continuing professional development and training over the period they work for the company. This is related mainly to transferable skills but there is recognition by employers that retaining employees within the business demands a package of human resource measures, including the provision of training. A balance has to be found between the delivery of those social goods that the employee expects - which would result in job dissatisfaction if not delivered and which improve their position in the external labour market (i.e. training paid for by the employee) - and the provision of those human resource policies which will retain the individual in the business. This includes non-pecuniary goods such as a working environment which persuades the person to stay with the employer, which appears to work well for the large accountancy firms.

There is no guarantee, as for accountancy where the practice appeared to be fairly standardised across several Member States, that there will be a common EU-wide social contract for all or many sectors. This will be depend on national conditions or a particular region or locality; the latter focus can be important. It is apparent across the EU that there are agglomerations and particular niches at regional or local level, such as financial services in London and Frankfurt, IT in the Paris region, or medical technologies in Baden-Württemberg. These have generally been able to produce high-skill, high-value employment with working conditions which would be considered relatively good by EU standards (high wages, high levels of personal autonomy, flexible working practices, etc.). Such conditions are not necessarily experienced by those working in the sectors outside of these dominant localities, hence, the need to pay attention to those regional or local factors which might influence the social contract at sectoral level.

6.4. Networks and clustering

Much of the discussion relating to the effects of clustering and networks comes from R&D spillover literature. Over recent years there has been a growing interest in the role of skills within networks. Research on high skill ecosystems (HSEs) in the ICT sector has drawn attention to its importance (Porter, 1990). In the case of California's Silicon Valley, the supply of high level skills alongside some other factors was seen as instrumental in bringing about that area's rapid industrial growth (Finegold, 1991). The particular mix of factors in place included:

(a) catalysts such as the funding provided by the US Department of Defence for new military hardware in the late 1940s. Firms were attracted by the cheap land prices, closeness to military bases, and supply of engineers from nearby universities in the Santa Clara Valley, which eventually led to the development of Silicon Valley;
(b) nourishment to sustain growth; California Universities were able to supply new talent to the new industries developing the region, which led to closer industry university links;
(c) a supportive environment for growth; increasingly this has meant good access to global markets, the existence of incubators and science/technology parks, and a culture that encourage risk taking;
(d) interdependence between companies and individuals; ideas are shared through horizontal links, in which highly specialist companies partner others with complementary skills, or by vertical connections among firms at different sections of the value-chain; here an initial idea developed by one company is passed to another for the next stage of development, before eventually being passed to a large-scale manufacturer. Networks among individuals are important and California has several forums where individuals and firms can share ideas.

In the case of the Boston life sciences cluster, Porter and Ketels (2003) identified a similar set of factors in place. If the supply of skills, and the sharing of knowledge among companies through a range of forums, are seen as important in developing a sector at local level, then why not issues relating more generally to the quality of the working environment? There is evidence suggesting that organisations share comparable working patterns (Tamkin et al., 2008; Temple, 2005). At its simplest this might be limited to issues relating to the retention of highly valued employees; on a more sophisticated level it might be seen as a means of getting the best from employees. At local level there may well be more than an exchange of ideas in relation to technologies, skill development, and working practices; there may be the coordination of activities regarding development of the public good called human resources.

To illustrate networking, or clustering, of employers within a sector, the following sectoral case studies concentrate on those found within geographical clusters. Networks of firms exist beyond regional boundaries, but, in this study, the use of sector-region cases illustrates how firms form collaborative working relationships, based on sharing knowledge, and obtain benefits from having access to a pool of knowledge. The success of collaborative working and knowledge sharing is dependent on human resource practices which emphasise

employment retention within the firms. Where employers are in competition for labour, this tends to negate the possibility of collaborative working.

6.5. Medical technologies in Baden-Württemberg

6.5.1. Historical evolution of sector and region

Medical technology by definition 'extends and improves life. It alleviates pain, injury and disability. [...] Incessant medical technology innovation enhances the quality and effectiveness of care. Billions of patients worldwide depend on medical technology at home, at the doctor's, at hospital and in nursing homes. Wheelchairs, pacemakers, orthopaedic shoes, [...], insulin pens, hip prostheses, [...] pregnancy tests [... and] life-support machines: more than 500 000 products are available today' (Eucomed, 2007). Products are normally based on mechanical, electrical, and (or) material engineering. Medical technology products typically have an average lifecycle of 18 months before improved products are available; there is a high level of innovation within the sector, achieved by a high share of research and development activity.

The European medical technology market is the second largest behind the US in terms of sales. Within Europe, Germany represents the largest market with around one third of sales. The structure of companies in the sector is mainly small- and medium-sized enterprises (SMEs), more than 80% of the existing 11 000 medical technology legal entities in Europe. The European medical technology industry employs around 435 000 people and annual spend on research and development is around EUR 3.8 billion (around 6% of sales) (Eucomed, 2007).

Focus on Baden-Württemberg

The State of Baden-Württemberg holds a strong position in medical technologies within Germany, at 23% (EUR 4.2 billion) of sales, and also in the European context. Around 2 500 companies (22% of all medical technological companies in Germany) are located in the south western part of Germany, employing around 31 000 employees (BW Invest, 2011). Almost every product group in the sector is produced in the State: for example anaesthetic products, surgical instruments, diagnostic instruments, imaging diagnostics, implants, and non-invasive surgery supplies ([27]). Several original equipment manufacturers (OEMs) are also located in Baden-Württemberg (IER, 2004). According to the EU European cluster

([27]) A complete list can be found in BW Invest, 2011.

observatory, the region comprising Freiburg, Karlsruhe and Tübingen is the most important medical technology cluster in the EU, with the cities Karlsruhe and Heidelberg having a leading role in life sciences. The German Cancer Research Centre (Deutsches Krebsforschungszentrum, DKFZ), and BASF, register most of the industry-relevant patents in Germany (BW Invest, 2011).

Baden-Württemberg has a long history in manufacturing, engineering and light industries. Its economic backbone has always been its high share of SMEs, though there have been large businesses (such as Bosch, Porsche, SAP, Heidelberg Printing Systems, and Daimler). As an industrial region, it has been hit by several industrial crises: in particular the textiles and clothing industries, which are concentrated in the southern region of Tübingen, have been in long-term decline. So, the region started to focus on medical technologies to compensate for the shrinking levels of production in textiles and clothing. The region was able to capitalise on the competences of its qualified workforce, in particular the strong tradition in instrument engineering (Vogler-Ludwig and Plesnila-Frank, 2003). In Tuttlingen, a cluster for surgical instruments developed which could use existing competences in surface mechanics and metal processing (source: expert interview). Tuttlingen and Tübingen-Reutlingen have together developed a unique concentration of specialisation in surgical instruments. Over the past 20 years companies have widened their product portfolio with medical technological products and specialised in products for minimal invasive surgery. The latter was supported by cooperation from the university hospitals in Tübingen and Stuttgart (IER, 2004).

Developing the medical technology sector in Baden-Württemberg has come about due to the region‘s historical industrial strengths, combined with initiatives from universities, research institutes and private business (IER, 2004), especially the volume of research undertaken there. In 2010, 3.9% of regional GDP was spent on R&D. This offers a high degree of research potential for medical technology. Together 80 institutes and centres undertake research and development in medical technology. In addition to the Karlsruhe Institute for Technology (KIT) several Fraunhofer Institutes, Max-Planck-Institutes and research institutions at universities and universities of applied sciences, are based in the State (BW Invest, 2011). Medical technology companies are also supported by the innovation potential resulting from existence of the 80 biotechnology companies in Baden-Württemberg.

Medical technology networks within Baden-Württemberg strengthen the innovation potential and international competitiveness of companies: there are 17 active cluster-initiatives and sectoral networks. The highest density of endoscopy and surgical instrument companies in the world is in Tuttlingen. Global leading

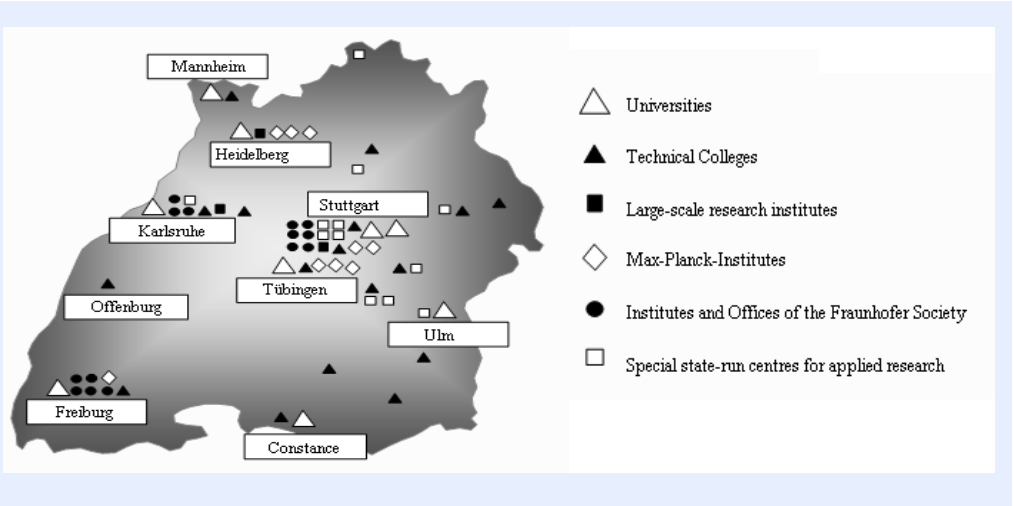
companies in this sub-sector such as Aesculap (B Braun Group), Karl Storz, Gambro and Erbe are based in this region. Baden-Württemberg has one of the highest number of new patent registrations in Europe. Stuttgart, Karlsruhe, Tübingen and Freiburg are in the 20 top regions in Europe with the highest share of patents per capita (Brainport Foundation, 2009).

6.5.2. Organisation of VET

According to a study by IER (2004), which compared six regions focusing on medical technology, differences in training strategies are apparent for different areas. In regions with a long history of medical technologies, the workforce and products are of high quality. The medical technologies sector often developed from existing sectors, for example, information technologies as in the US or mechanical engineering as in Baden-Württemberg. The relatively large volume of R&D and patenting activity is strongly linked to the higher education sector. Qualifications related to R&D processes and research scientists and engineers are most important. Manufacturing skills, as provided by a great variety of skilled blue collar workers (Facharbeiter), are the basis for achieving high quality standards in production. Production line managers and business specialists such as marketing and sales experts are also needed (IER, 2004).

Companies located in Baden-Württemberg have the advantage that they can recruit from a high number of graduates from educational institutions: there are nine universities, 23 universities of applied science and nine universities of cooperative education. One quarter of the research capacity of Germany's large research institutions are based in Baden-Württemberg. There are also 12 Max-Planck research institutes, 48 research institutes of the Fraunhofer Societies, and more than 100 non-university research organisations with links to the university landscape (BW Invest, 2011). Figure 18 gives an overview of the density of education and research institutions in Baden-Württemberg, illustrating the strength of the academic and educational infrastructure in the State.

Figure 18 **Educational and research landscape in Baden-Württemberg**



Source: Vogler-Ludwig and Plesnila-Frank, 2003.

The main strength of the medical technological companies in Baden-Württemberg is their innovative power: 50% of sales in the sector are generated by products which are less than three years old. This is mainly achieved by cooperation between companies and research institutions (BW Invest, 2011). The State promotes the medical technology sector through numerous initiatives:

(a) the Ministry of Economy in Baden-Württemberg fosters SMEs in the fields of medical technologies and health economy in the cluster region Tuttlingen, Tübingen and Reutlingen. The companies are supported by professional cluster management from the cluster initiative Medical Mountain; this receives EUR 405 000 from the ministry to extend the international networks of companies and to promote the transfer of technologies among companies (Wirtschaftsministerium Baden-Württemberg, 2011);

(b) technology transfer, group research, and the research infrastructure of clusters within the medical technology sector are promoted by the Baden-Württemberg Ministry of Science, Research and Art (MWK). Support for projects helps secure competitiveness, employment and sustainable development (MWK, 2011a). There is a view that joint research among companies needs to be stimulated and managed, otherwise it will not be achieved (source: expert interview);

(c) R&D projects at universities of applied sciences are generally promoted by the State, particularly for cooperation projects among universities of applied science, companies, universities, and research organisations (MWK, 2011b).

Developing medical technology is supported by the existence of the different clusters in Baden-Württemberg. Medical technology clusters offer its actors

structures to develop market-based technologies, competitive advantages through cooperation among organisations, and support for start-ups. One of the key medical technology groups is the Tuttlingen-cluster of Tuttlingen, Hechingen, Tübingen and Reutlingen, cities where many highly-qualified medical technology companies are based. Universities and research institutes are at the heart of the cluster and application-oriented centres for innovative medical technology assist the regional economy. The pivotal strategy of the cluster targets interdisciplinarity and a sustainable interconnection along the whole supply chain. The success of a cluster stands and falls according to the quality of connections within it. Therefore, the actors in the Tuttlingen-cluster have committed to a 'culture of cooperation' in which all partners treat each other with respect and fairness.

Companies located in Baden-Württemberg can make use of a well-developed supply of local skills. These are provided by local universities and the VET system.

6.5.2.1. *Tertiary education*

The tertiary landscape in Baden-Württemberg provides highly-qualified labour resources and high intensity of research. At the nine universities and 23 universities of applied sciences, students can study subjects related to medical technology. This focus is especially found in Heidelberg, Karlsruhe, Stuttgart and Freiburg.

An increasing number of German tertiary institutions offer study courses — Bachelor or Master — in medical technology. These courses are a combination of medicine, engineering, science and economics. Across Germany 42 tertiary institutions provide study courses in medical technology or a related subject; nine of these are in Baden-Württemberg (Yellowmed, 2011). There are five Bachelor study courses in medical technologies at the universities of Ulm, Stuttgart, Tübingen, Mannheim and Offenburg, one Master course at the University of Ulm ([28]) and Bachelor courses in medical engineering, industrial MedTec, medical informatics, and IT in healthcare (Table 30). Other courses, in different disciplines, allow specialisation in medical technology. Most of the courses have been established over recent years; there were no dedicated programmes for the sector i.

([28]) Studieninformation Baden-Württemberg, Studiengangsuche [Degree programme search] (http://www.studieninfo-bw.de/index.php?id=1126).

Table 30 **Study courses in medical technology or related disciplines**

Study course	Graduation	Year of implementation	Universities (of applied sciences)	Contents/specialisation
Medical Technologies	Bachelor	2007	University of applied science Ulm	Medical instrument engineering, Biotechnology
Medical Technologies	Bachelor	2010	University Stuttgart (in cooperation with Tübingen)	
Medical Technologies	Bachelor	2010	University Tübingen (in cooperation with Stuttgart)	
Medical Technologies	Bachelor	2008	University of applied science Mannheim	Application of technical informatics and electronics in medicine
Medical Technologies	Bachelor	2010	University of applied science Offenburg	
Medical Technologies	Master	2008	University of applied science Ulm	Medicine, engineering, simulation and modelling, management and quality
Medical Engineering	Bachelor	2007	University of applied science Furtwangen	Biomedical techniques, surgery engineering
Industrial MedTec	Bachelor	2010	Hochschulcampus Tuttlingen	Surgical instruments, implants, minimally invasive procedures, medical instrument engineering
Medical Informatics	Bachelor	1972	Hochschule Heilbronn	Medical IT
IT in healthcare	Master	2011	Hochschule Krems	Extra occupational study course.

Source: Yellowmed, 2011; Studieninformation Baden-Württemberg, Economix.

6.5.2.2. *Intermediate VET*

There is initial and continuous vocational training for medical technologies at intermediate level (Table 31). In Baden-Württemberg, vocational schools in Heidelberg (Carl-Bosch-School) and in Esslingen (Medical Technical Academy) offer the option of continuous VET (CVET) to become a medical technician (*Medizintechniker*). CVET lasts for two years and it is required that vocational training (dual apprenticeship or at a full-time vocational school) was successfully completed in electro-engineering or metal processing and the person has job experience of one to three years.

IVET to become a medical technical assistant with focus on radiology is provided at several vocational schools. Training to become a medical technical assistant with focus on functional diagnostics and the specialisation as a medical technical assistant with focus on nuclear medicine are not yet common in the State.

The surgery-mechanic guild in Tuttlingen provides higher vocational training (*Meister*) to become a surgery mechanic craftsman (*Chirurgiemechanik Handwerker*). The course is provided at the vocational school, Ferdinand-von-Steinbeis Schule, in Tuttlingen (Landesinnung Chrirurgiemechanik Baden-Württemberg, 2011).

Table 31 **Intermediate vocational education and training for medical technology**

VET	Kind of VET	Provider in Baden-Württemberg
Medical technical assistant — radiology	IVET at full-time vocational schools	• State-approved school for medical-technical radiology assistants in Heidelberg • School for medical-technical radiology assistants at the clinical centre Karlsruhe • MTAR-school of the university hospital Eberhard-Karls-University Tübingen • Academy for health occupations at the university hospital Ulm • University hospital Freiburg Academy for medical occupations • Medical Technical Academy Esslingen
Medical technical assistant — functional diagnostics	IVET at full-time vocational schools	SRH occupational rehabilitation Heidelberg
Medical technical assistant — nuclear medicine	Specialisation	
Medical technician	CVET	• Carl-Bosch-School, Heidelberg • Medical Technical Academy Esslingen
Surgery-mechanic craftsman	Higher vocational training (Meister)	Vocational school in Tuttlingen (Ferdinand-von-Steinbeis Schule)

Source: Kursnet, the portal for professional training and development (http://kursnet-finden.arbeitsagentur.de/kurs/index.jsp).

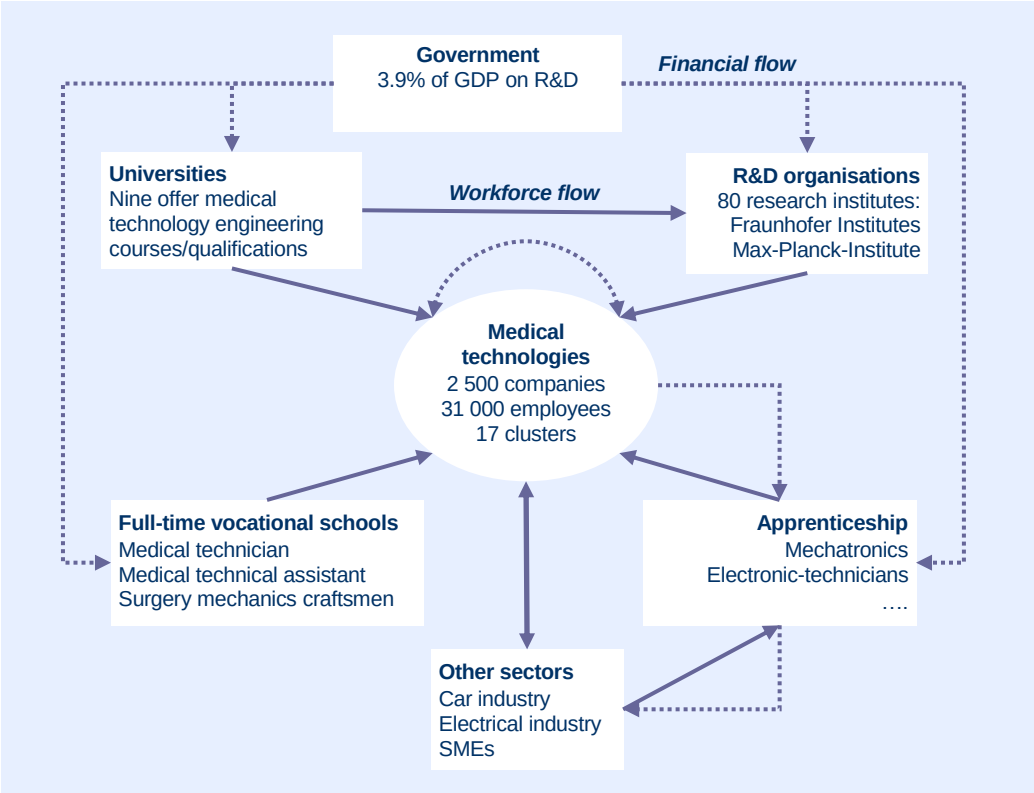
6.5.3. Management of skills in a technology cluster

The development of medical technology in Baden-Württemberg and the formation of a medical technology cluster were historically influenced by the existence of relevant competences. In the area around Tuttlingen, companies specialised in surgical instruments could make use of existing competences among cutlers and craftsmen (source: expert interviews). There was a similar relationship between mechanical and instrument engineering competences, in companies specialising in micro mechanics and clock making, and the development of medical technologies (source: expert interviews). The further development and growth of the sector was positively influenced by the parallel development of the automobile sector in Baden-Württemberg. Much of the VET in the automobile sector is also important for the medical technology sector.

The specialisation in medical technology products in the region, however, was based on more than just the availability of a skilled workforce. A whole

network of actors joined and focused efforts on establishing a competitive medical technology sector (Figure 19).

Figure 19 **Skills management in medical technologies**



Medical technologies fitted into the specialisation profile of the Baden-Württemberg economy and its high share of manufacturing industries, such as automotive and electrical sectors; the skills base was available from its historical roots. The development into medical technologies was an incremental, rather than a radical, step.

This, however, was not sufficient, as it was clear that successful development of such a sector depended on a comprehensive strategy in which the skills base played a central role. All actors seemed to agree on the importance of a quality workforce to the success of the strategy:

(a) the government decided not only to invest in research and development in general but also created research institutes that specialised in medical technologies. It supported universities in creating special courses for medical technology engineering, and it founded full-time vocational schools for

medical technology technicians to promote specialisation at higher intermediate levels, the *Meister* qualifications in particular;

(b) companies invested in apprenticeship training as they traditionally do in Germany; modern types of apprenticeship such as 'Mechatronics' helped to meet skill needs in the sector. However, they realised the rather weak position of most SMEs regarding investments in human capital. The State government came in and not only financed the school-based part of apprenticeship training but also took on all the costs of higher level vocational training. A highly fluid labour market developed, where companies exchanged staff and improved labour allocation. This was supported by the creation of 17 regional clusters which serve as exchange forums among the companies;

(c) companies also profited from the broad supply of labour skilled in manufacturing and business-related occupations. As skills supply has the features of network-based infrastructure, both the risks and the costs of poaching decrease with the volume of supply. Under the condition of strong skills supply, therefore, workers who leave the company can be replaced easily and adjustment costs are low.

These conditions resulted in an economic upswing in the medical technology sector, strong enough to avoid the exodus of manufacturing activities in other parts of Germany. The existence of the competences needed and the high quality of work in Baden-Württemberg were sufficient for companies not to outsource their production to countries with lower production costs. Some companies even relocated their production to Baden-Württemberg for the high quality of skilled workers in the region.

6.6. Textiles in Flanders

6.6.1. Historical evoluti on of the sector

Textiles is one of the oldest European industries and its shape has changed considerably over recent decades. At the end of 2004 the World Trade Organisation's transitional agreement on textiles and clothing terminated. At the same time, developments in global transport and communications (Eurofound, 2008) meant increasing global competition, in particular from China and other Far Eastern countries. Many European countries used the new strategic options and moved manufacturing activities to low-wage countries in Eastern Europe or to countries such as India and China, causing a considerable decline in sectoral employment in Europe (Vogler-Ludwig and Valente, 2009).

Between 1996 and 2006 the European textiles industry experienced a rapid reduction in output and prices. Production volumes declined by 22%, a figure exceeded by the clothing (-45%) and leather sectors (-32%). In the same time period employment textiles, clothes and leather products lost one third of its jobs.

In 2006, the EU-27 textiles industry comprised around 79 100 enterprises and employed 1.06 million people. The estimated value added was EUR 30 000 million in 2006 (European Commission, 2009).

Developments in the Belgian textile industry mirrored those of other West European countries, following the trend of relocating manufacturing to low-cost countries. In the 1980s there was substantial restructuring and the Belgian government introduced the Textile Plan to support the industry and to improve education and research. It offered subsidies for companies to invest in new equipment, allowing for example, the textiles laboratory of Ghent University to expand ([29]).

Today, around 85% of the Belgian textiles industry is located the provinces of West Flanders and East Flanders, in particular in the cities Ghent and Courtrai (Kortrijk). There are around 800 textiles companies, of which half have fewer than 10 employees. They offer a variety of products and operations: indoor textile, garment textile, technical textile, (bespoke) textile finishing and spinning mills (short and long fibres) ([30]).

The number of employees is about 25 000. Since 1990 the number of employees declined by more than 60% (Table 32). Within the last three years the sector lost about 5 000 jobs due to the global economic and financial crisis. According to an expert interview, a reduction of a few hundred employees per year is expected in the coming years.

The level of educational attainment in the Belgian textiles industry has increased within the last two decades, but no figures are available. Many workers do more difficult jobs today (more work with computers and less manual labour) than 20 years ago without a higher educational qualification. However, many highly educated people are entering the industry, for example, chemists or IT engineers.

([29]) Ghent University, Department of textiles (http://www.ugent.be/ea/textiles/en).

([30]) Federation of the textile, wood and furniture industries (http://www.fedustria.be/).

Table 32 **Development of the Belgian textiles industry**

Year	1990	2000	2010	Expectation 2020
Number of companies	1 500	1 200	800	—
Number of employees	65 000	45 000	25 000	—
Share of interior textiles	50%	45%	45%	40%
Share of technical textiles	15%	30%	40%	50%
Share of apparel and others	40%	25%	15%	10%

Source: Federation of the textile, wood and furniture industries (http://www.fedustria.be/).

In 2009, total sales in the Belgian textile industry was EUR 5.5 billion, with 42% from interior textiles, 36% from technical textiles, and the rest from apparel (15%), finishing (5%), and spinning (2%) (Fedustria, 2010).

Although the industry is shrinking in quantitative terms, its quality is improving due to the growing importance of technical textiles: the share increased from 10% in 1990 to 40% today and is expected to increase further. There is a marked move toward a higher value-add, research and know-how intensive sector.

Technical textiles comprise several completely different products, for example protective clothes for workers in the chemical industry, automotive textiles (e.g. seat belts), geo-textiles (need for road construction) or artificial turf. The importance of apparel and interior textiles (e.g. carpets) has continuously declined, even though Belgium is a major supplier of carpets and rugs and has delivered 50% of European production for more than 20 years.

According to an expert interview, the global textile sector is not expected to grow but will stay more or less at a stable volume. Following extensive restructuring in Belgium what is left is sustainable. While interior textiles are expected to lose about 2% of volume per year, technical textiles will increase by 3% per year. Apparel textiles will not dramatically shrink further as existing companies are specialised niche manufacturers.

6.6.2. Organisation of VET

6.6.2.1. *Research and development strategy*

Research and development gained importance in the restructuring of the textile industry, from apparel towards a focus on technical textiles. Companies spend 5-10% of turnover on R&D in technical textiles, while in the rest of the sector they spend about 1%. In Flanders, R&D expenditure is about 2% of GDP.

There is no special Belgium government promotion for the textiles industry but specific support would be welcome (source: expert interview). As in every other sector in Belgium, companies can apply for public grants, for example from

the Institute for the Promotion of Innovation, the Science and Technology in Flanders (IWT), or the National Fund for Scientific Research (FWO). Group initiatives are also supported. The Agendschap Ondernemen — an enterprise agency of the Flemish government — also supports entrepreneurs in innovation, new projects, and expansion plans (Agendschap Ondernemen, 2011).

Cooperation is encouraged between research institutions and companies, for example by Centexbel (Section 6.6.2.3, b ii), but cooperation between higher education institutions and companies is thought to be under-developed. Over recent years, there has been little cooperation, with few companies contracting local universities to undertake research projects on their behalf. To foster innovation and increase cooperation between higher education institutions and companies, an organisation (an 'incubator' or 'accelerator') was established by the government and a local university in April 2011. In addition, know-how transfer between research institutions and companies was imporved. Ghent University plans to open its first spin-off company for the production of nano-fibres this year (2011) (source: expert interview).

6.6.2.2. *Training strategy*

As the sector experienced major restructuring over the last 30 years the training strategy focuses on delivering new qualifications needed in the sector. Education in textiles in Belgium focuses on the production of materials and particularly on technical textiles. The demand for labour, however, from textile companies in the Belgian textiles industry is not satisfied; this is seen in the low number of students interested in studying textile technology. Students often do not expect a course in high-tech engineering in the sector (source: expert interview) and textiles education institutions have around 300 students a year. Training institutions are keen to improve the image of studying and working in textiles. Companies recruit mechanical or chemical engineers or ICT specialists from higher education, even though a specialisation in technical textiles would be preferred., People trained in textiles are also needed at intermediate skills level, for example to operate the machines in the production process.

6.6.2.3. *Education and research institutions*

Higher and secondary education institutions

(a) Ghent University, Department of Textiles offers a Bachelor of chemical engineering and materials science (three years) and a Master of materials engineering with the main subject textiles (two years) in Dutch. Ghent University is also part of AUTEX, the Association of Universities which provides the European textile engineering advanced Master (E-TEAM), a

two-year course lectured in English. All major European universities offering textile education participate in the programme and students study at three different universities. For example the course in 2010-12 takes place at Ghent University, University of Manchester (UK), and University of Istanbul (Turkey) (Ghent University, 2010). There are about 20-25 students a year in the Department of textiles and 5 to 10 graduates per year, of whom half are continuing with PhD studies (source: expert interview). The Department of textiles undertakes research in several fields, for example in the biotechnological functionalisation of textiles, electro-spinning of nano-fibres, high performance fibres and structures, and conductive and smart textiles;

(b) Hogeschool Gent (University College Ghent) provides a Master degree in textile industrial engineering sciences (four years) and a Bachelor degree in textile or clothing (three years) in Dutch. There are about 40 to 50 students in textiles per year at this university college. Its textile research centre TO2C largely focuses on practically-oriented research in textile finishing (pre-treatment, dyeing, printing, coating and laminating). TO2C's laboratory provides research services for companies or assists them through innovation in products, services or production processes. Research activities particularly focus on new technologies, advanced products for special niches including technical textiles (such as construction, transport or medical textiles), (Belgian Research, 2007). Hogeschool Ghent also has an initiative called texstream.be, which aims to bring news from the textiles industry to the public and informs them about product developments in geo-, agro-, and sport textiles. It wants to improve public awareness that these are high-tech products developed and produced in Belgium ([31]).

Two schools organise secondary education with specialisation in textiles. They are located in Courtrai and Waregem. About 250 students are enrolled in the textiles education a year (source: expert interview). Students start at age of 13 or 14 years and education lasts four years. Two pathways are distinguished: technical secondary education (TSO) and vocational secondary education (BSO), with the latter having a stronger focus on practical skills. Students with this secondary education are needed in clothing and technical textiles companies for operating machines, preparation, production and finishing textile products. A third school terminated secondary education in textiles recently because of too few students ([32]).

([31]) Federation of the textile, wood and furniture industries (http://www.fedustria.be/).

([32]) WIBSO Waregem Website: textieloperator (http://www.vibso.be/textieloperator.html).

Continuing training and research

(a) Cobot, is a schooling and training centre initiated by the social partners. It coordinates several training programmes, assists job-seekers in finding new positions in the sector, and gives advice to companies regarding skills development, planning, execution and follow-up of training activities, recruitment of employees or subsidy channels for training. Restructuring processes made continuing training more specific: 20 years ago about 90% of courses at Cobot were general/open courses, whereas today more than 80% are tailored in-company courses;

(b) Centexbel, is the most important textiles technology centre in Belgium. It was founded in 1950 at the initiative of Fedustria, the Belgian federation of the textile, wood and furniture industry, to reinforce the competitive position of Belgian textile companies. With more than 100 employees, it provides services to the textile industry such as testing, certification, consultancy and R&D. It gives independent and objective advice regarding research and supports networking within the sector ([33]);

(c) Cefret is the Centre for Training for the Textiles Industry and provides continuing education for textile workers and job seekers. It is located in Mouscron, the Walloon part of Belgium and organises and gives training for the French-speaking and German-speaking parts of Belgium. It provides information to students in vocational textile education, organises training for workers who have to develop new skills, and supports redundant textile workers. It is supported by the European Social Fund ([34]) .

6.6.3. Skills management

For an industry that lost more than 60% of its employment over the last 20 years, the production of highly specialised, high value-added products was the only alternative to total demise. Companies in interior textiles (in particular in the carpets and rugs sub-sector) and apparel, which still exist after years of restructuring, are now specialised niche manufacturers which can withstand the pressures of global competition. However, many companies specialise in technical textiles. About two thirds of technical textiles companies in Belgium developed their activities from a traditional textiles base, such as clothing and home textiles. For example artificial turf (grass) developed from tufted carpets, protective clothing from fashion fabrics, and technical medical yarns (for surgery) (source: expert interview).

([33]) http://www.centexbel.be/.

([34]) http://www.cefret.be/cefret2/.

These developments were strongly supported by research activities in Centexbel, Ghent University and University College Ghent. The regional concentration of these institutions promoted innovation in technical textiles and allowed the 'research-led' restructuring of the industry.

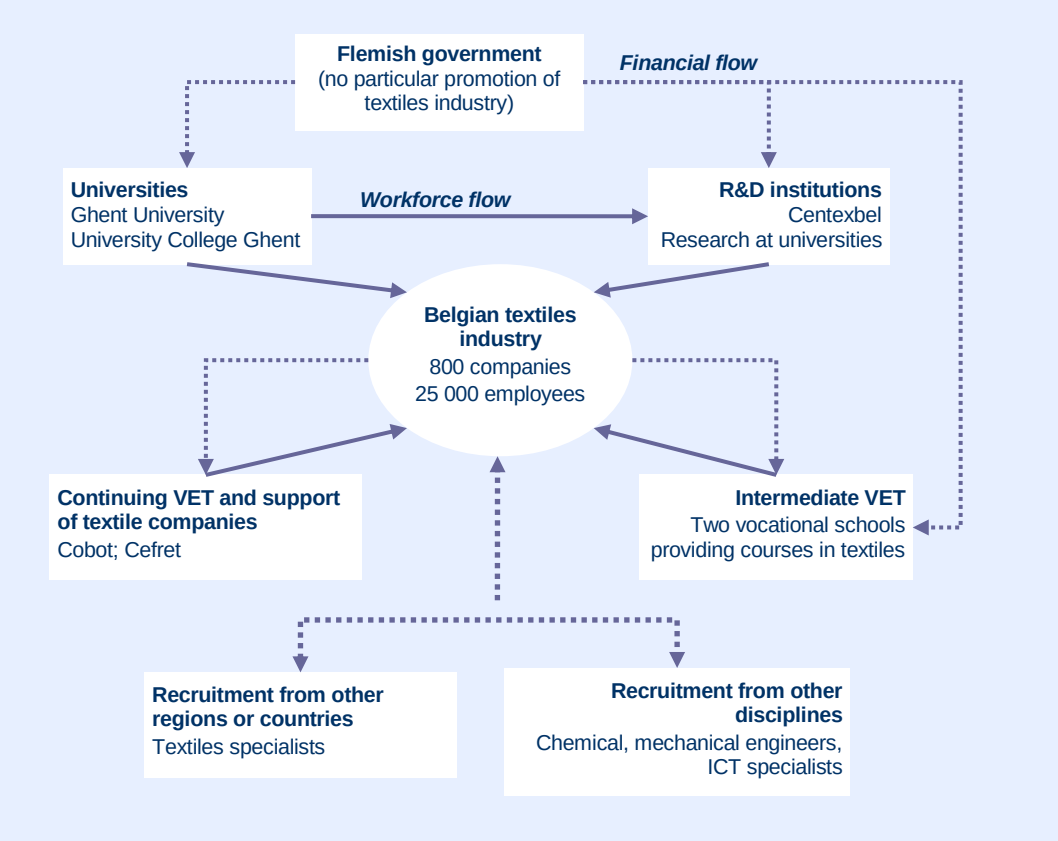
This was supported by changes in education and by continuing training within companies:

(a) education institutions had to adapt their courses towards research. For example, Ghent University concentrated on textiles engineering about 10 years ago. Cooperation with other subjects (chemistry, mechanical engineering and ICT) was essential. Without the Department of Textiles at Ghent University 'the transformation of the sector would have been more difficult and a collapse of the industry could have been a likely consequence' (source: expert interview);

(b) new production processes and new products were introduced in existing textiles companies through continuing training, an example being those organised by Cobot. Within the last 20 years, workers have had to adapt to technological change and learned to move from manual to computer based production systems.

The cooperative structure of education and research in the Belgian textiles industry is shown in Figure 20. Even though there is no particular promotion programme for Belgian textiles, companies are supported in innovative projects and research. It is one of Fedustria's aims to improve cooperation among companies. Product diversity in technical textiles is supported by cooperation and 'open innovation', as there is little direct competition among companies. Moreover, Centexbel plays an important role in short and medium-term developments arising from applied research in cooperation with companies.

Figure 20 **Belgian textiles industry**



Due to the low number of textiles graduates in Belgium, companies recruit engineers from other fields to meet their skills needs. Sometimes Belgian textiles companies recruit graduates from the college ENSAIT in Roubaix or from Lille (France), which also provide courses in textiles. In east European countries there are higher numbers of graduates in textiles, but they often have qualifications relating to the 'old' textile industry and do not have enough skills for the new, advanced types of textiles. In this context, increasing the number of students in Belgian textile study courses is important for two reasons: for the development of the industry and for justification of public expenditures on textiles education (source: expert interview).

6.7. Wind power engineering in Jutland

6.7.1. Evolution of sector and region

The establishment of modern wind power engineering in Denmark started in the late 1970s as a reaction to the oil crises in 1973 and 1979 which starkly revealed

the dependency of the western part of the world on importing energy. It seems natural that Denmark became the first country in which wind technology was used for electricity generation as it has no other natural energy sources: the Danish climate is characterised by consistent, strong westerly winds along the country's long coastline.

Poul la Cour and a team of scientists built the first windmill in 1891, funded by the Danish government with the aim of testing wind power for electricity production. During World War I and II the importance of wind energy increased with restricted access to fossil fuels but due to low oil prices during the 1960s wind energy was ignored until the 1970s. It was put back on agenda after successive oil crises (Vestergaard et al., 2004).

In Denmark the existing high levels of R&D helped to specify the three-bladed wind turbine as the standard design for the generation of wind energy at the end of the 1970s; since then, industry has continuously developed throughout the 1980s and 1990s. The government prohibited the development of nuclear energy plants in 1985 and, at the same time, provided priority access to the electricity grid to the wind sector and improved the infrastructure to enable additional wind-generated electricity capacity. It also put in place a system of fixed incentives for wind energy production which lasted for 20 years, such as a price guarantee per produced kilowatt-hours (kWh) for the owners of windmills (Morthorst, 1999). These subsidies made production of electricity profitable for private investors and hence competitive in the market for electricity produced by fossil fuel (Hansen et al., 2003). Annual subsidies were between DKK 1.7 billion (EUR 0.23 billion) ([35]) and DKK 2.6 billion (EUR 0.35 billion) between 2001 and 2005 (Cedefop, 2010). Today, Danish manufacturers produce around 40% of the cumulative generating capacity worldwide, with Vestas being the dominant company in the industry.

6.7.1.1. *Current performance*

The wind power engineering industry located in Denmark generated a turnover of around DKK 51.1 billion (EUR 6.85 billion) in 2009, a drop of 3.6% compared with 2008. In comparison, turnover increased by 25.6% between 2007 and 2008. The Danish power engineering industry generated a global turnover of DKK 91.4 billion (EUR 12.26 billion) in 2009 which was an increase of 9.1% compared to 2008. The Danish wind power engineering industry's exports account for 8.5% of total Danish exports. Total exports of wind turbines, components and services amounted to DKK 41.7 billion (EUR 5.59 billion) in

([35]) 1 EUR = 7.457 DKK.

2009. As a result of the financial crisis, the total number of employees decreased by 13% between 2008 and 2009. At the end of 2009, 24 700 persons were employed. For 2010 a moderate growth in sales and employment was expected (Danish Wind Industry Association, 2010). There are no official statistics on the total number of wind power companies in Denmark, because wind power is often a part of an overall product portfolio. According to the Danish Wind Industry Association around 255 companies are members in the association, though not every company is on the membership list (Danish Wind Industry Association, 2011a).

6.7.1.2. *Energy strategy 2050*

At the beginning of 2011 the Danish government published its *Energy strategy 2050* which explains how Denmark will achieve its independence from fossil fuels by 2050: one aspect is an increase in wind power. By 2020 wind production will be doubled and approximately 40% of overall electricity consumption will be covered by wind power. To increase renewable energy the government also plans to create an overall strategy related to research and development and to support the development of minor renewable energy technologies, for example solar and wave power (Danish Governement, 2011).

6.7.2. Organisation of VET

6.7.2.1. *Training strategy*

The wind power engineering sector requires knowledge and competences in construction and maintenance. In the manufacturing of turbines and components the workforce mainly has upper secondary qualifications, for example as industrial technicians or electricians (Cedefop, 2010). For the production of wind turbines the following work tasks are defined:

(a) creating technical drawings of windmills and individual subsystems;
(b) assembly and disassembly of wind turbine parts;
(c) installation of wind turbine systems and technologies;
(d) adjusting engine and other technical installations on the wind turbine;
(e) use of measurement and diagnostic tools to identify errors;
(f) specialisation in wing technology and engine technology;
(g) generic skills regarding project management, communication, cooperation, and language skills.

In recent years the wind industry has demanded vocational training specifically aimed at the wind energy sector in Denmark. Large companies such as Vestas and Siemens lobbied for a special training programme for several

years. In response, senior secondary vocational training as skilled wind turbine operator was introduced in 2009. The first students will enter the job market in 2011-12. The contents of the programme were identified by surveying companies of the wind power industry. Master courses specialising in wind energy have also been introduced.

6.7.2.2. *Research and development*

Universities and research institutions are important partners for the Danish wind industry. Danish research institutions carry out research at high international level and contribute to the creation of new knowledge used in the industry. To stay competitive internationally, the Danish wind energy industry needs to make wind turbines more productive and to lower operating costs by developing components which need less maintenance. The Danish Council for Strategic Research programme commission on sustainable energy and environment has established two large-scale research centres for Danish wind power engineering. Research activities in these centres will focus on turbine materials and aerodynamics (Sørensen et al., 2010).

Another important cooperative R&D activity is the Megavind Partnership in which the Danish wind power engineering industry has formulated joint recommendations for research, development and demonstration (R&D&D) within wind power (Danish Wind Industry Association, 2011b).

Several programmes related to wind energy are funded by public spending ([36]):

(a) the energy technology development and demonstration programme (EUDP) supports the development and demonstration of new energy technologies;
(b) ForskEL funds R&D&D in environmentally-friendly electricity generation technologies and a reliable transmission system;
(c) ForskVL provides funding to increase the use of electricity-generating units with a lower electricity-generating capacity;
(d) ELforsk supports R&D&D projects which target more efficient electricity use;
(e) the Danish Council for Strategic Research (DSF) supports research dealing with sustainable energy and environment;
(f) the Danish National Advanced Technology Foundation promotes research and innovation in small- and medium-sized enterprises. Around 25% of the budget has been used for energy technology projects.

([36]) Danish Energy Agency website: Danish funding programmes (http://www.ens.dk/en-us/policy/energy_technology/danish_funding_programmes/sider/forside.aspx).

6.7.2.3. *Training institutions*

Tertiary education

Several universities in Denmark offer wind related education (an overview is also presented at Talent Factory website ([37])):

(a) the University of Aalborg (AAU) has offered a two-year Master programme since 2007 which targets those with engineering or mechanical qualifications who are working with wind turbines. It is a part time study programme for people who are working; it is modularised and offers the opportunity to complete courses and projects individually. The programme offers courses in wind turbine dynamics, design of wind turbine wings, and grid connections (Aalborg University, 2011a). The AAU also offers a two-year Master programme for wind power systems, focusing on electrical aspects, in subjects such as generators, power electronics, control engineering and power system technology related to wind power applications (Aalborg University, 2011b);

(b) many graduates from the Copenhagen University College of Engineering are employed in the industrial sector, including the wind industries. This applies especially to engineers specialising in mechanical engineering and electrical power;

(c) at the Engineering College of Aarhus (IHA), engineer training includes practical and professional designed to ensure that they are well placed to obtain jobs in the industry. IHA has partners in the Danish Wind Industry Association and offers a summer school which focuses on wind turbine technology in cooperation with industry;

(d) the Danish Technical University (DTU) has been involved in wind energy technology since the 1970s, and is among the world's leading universities in this field:

    (i) since 2001 the DTU has provided a Master programme in wind power; this is offered through collaboration between the Department of Mechanical Engineering, the Department of Electrical Engineering, the Department of Informatics and Mathematical Modelling (IMM), and the Wind Energy Department at Risø National Laboratory. The programme focuses on electrical and mechanical aspects of wind power and power system integration;

    (ii) the Centre for Electronic Engineering has courses on wind power and specialisation in wind energy. The objective is to give a general

([37]) Talentfactory: education (http://www.talentfactory.dk/education.html).

understanding of wind energy systems as well as profound insights into electrical technologies related to wind energy;

(iii) the Department of Mechanical Engineering energy research is centred on efficient exploitation of renewable energy resources such as biomass, wind and waves. Relevant courses comprise wind turbine measurement techniques, wind turbine technology and aerodynamics, and projects in wind turbine aero-elasticity;

(iv) Risø — the National Laboratory for Sustainable Energy at the DTU — provide a Master programme in sustainable energy to educate experts in various energy technologies and energy systems;

(e) the University of Southern Denmark targets its research and study at society's need for contemporary and relevant competences. It has exchange of competences with the wind turbine industry, including design, regulation, monitoring, construction and other areas of expertise. The Faculty of Engineering offers a wide range of education in engineering.

Continuous training

(a) the Danish University Wind Energy Training (DUWET) — a cooperation between Risø National Laboratory, DTU and the universities of Aalborg and Aarhus respectively since 2007 — provides various courses and consulting activities on research-based training in wind energy development. The courses are for professionals in the wind industry. Regular scheduled courses are offered around five to six times each year to 5-15 participants and there are several company-specific training programmes for which the participation numbers differ;

(b) the Danish Wind Power Academy (DWPA) was founded in 2004, since when it has offered customised training courses, safety and rescue courses for technical personnel at all levels (DWPA, 2011). On average around 400 workers in Danish wind power companies are trained each year.

Vocational education and training

A new VET course was introduced in 2009. The training programme for wind turbine operator comprises installation of wind turbines, handling of materials, and planning the process of creating and installing a wind turbine (Cedefop, 2010). It comprises two-year apprenticeship training with a combination of school- and work-based training: the supply of training depends on the willingness and ability of companies to offer it. The programme consists of half a year of basic training and one and a half years of specialisation in either wing production, or mechanics and assembly. While the basic training elements are

offered at several schools, specialisation is only provided at four schools: Tradium Randers, Skjern tekniske skole, EUC Vest Esbjerg, CELF Lolland Falster (Industriensuddannelser, 2011).

6.7.3. Skills management

The development of wind power engineering in Denmark was affected by three main drivers of change. First, after the oil crises in the beginning of the 1970s people wanted to use other energy sources to be independent of fossil fuels. Second, traditional competences in metal working, mechanical and electrical engineering were readily available from the declining shipyards to help development of the sector. Finally, from the beginning there was a long-term government strategy to support wind power in Denmark, which made investment less risky (source: expert interview).

Cooperation on research and education in Danish wind power engineering is shown in Figure 21. Companies have high demand for engineers in general and power engineers in particular. High growth rates posed challenges in recruitment of skilled workers so, since 2006, the Talent Factory — a cooperation among 14 Danish and international wind power companies — has supported this industry to ensure the recruitment of newly-educated engineers. The Talent Factory offers an intern platform with interesting information about career and education opportunities relevant to the sector as well as organising company visits, summer schools and conference trips in cooperation with the industry (Danish Wind Industry Association, 2009).

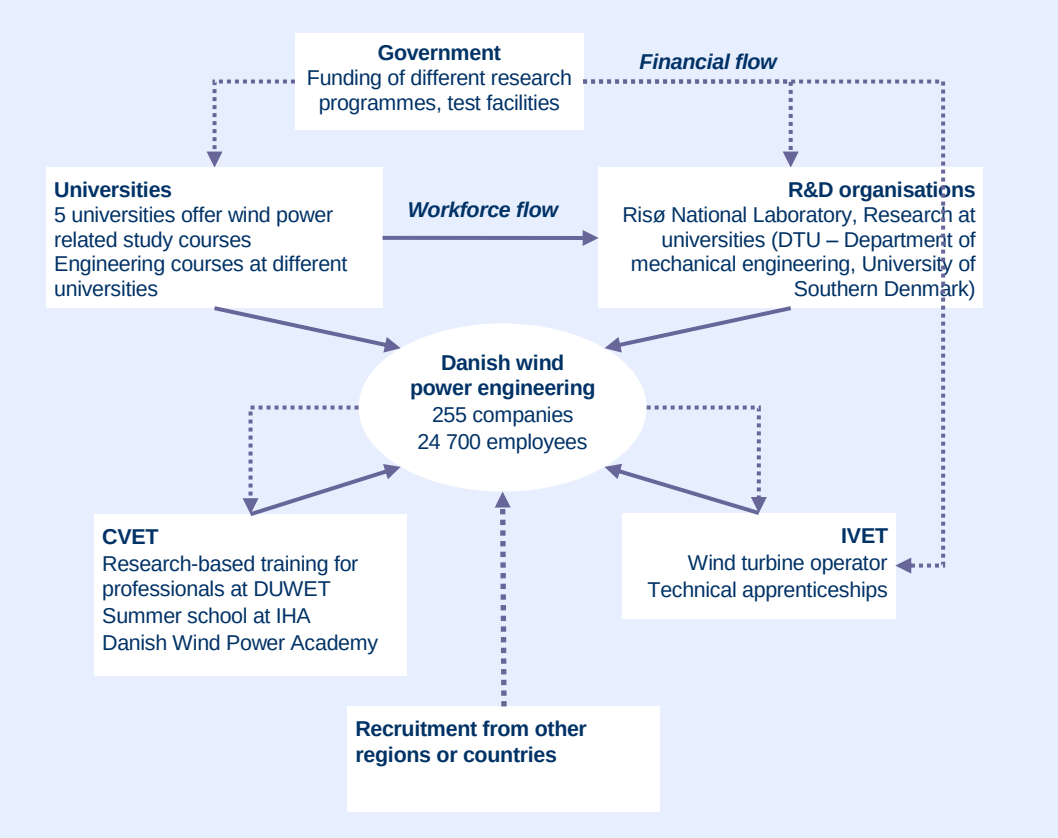
Graduates from specialised study courses for wind energy are in high demand from wind power engineering companies. It is, however, more important for the workers to hold basic/classic technical and engineering skills. In addition, every company needs to provide tailor-made company-based training to their employees as the wind turbines differ. Access to research-oriented education at high level for Danish engineers and other professionals is also important.

R&D is important to maintaining Denmark's position as world leader in wind power. Efforts are expanded to improve the productivity of turbines and the quality of components. The government consciously provides policy support to the wind power engineering industry and supports R&D by, for example, providing test facilities for turbines and components and several other funding programmes. The research structure and the supply of highly qualified workers for wind energy even attracted foreign wind companies (e.g. from China and India) to locate parts of their business in Denmark. Cooperation on research is especially important to technological development in smaller supply companies, as they often have difficulties in establishing formalised cooperation with universities due to a lack of resources. Even though large companies have their own research strategies and departments it is still important for them to have

access to the knowledge in universities and research institutions (source: expert interview).

There is every indication that the declining shipbuilding industry in Denmark will take the opportunity to move into wind power engineering. Existing competences from the ship building industry can be used in offshore wind energy engineering with a minimum of retraining. Such competences include automatic production with robotic devices, surface treatment, welding and outfitting (Cedefop, 2010). Also, employers have experience with underwater construction: offshore wind turbines are complex constructions with the foundation 30 meters in the seabed and around 40 meters of the turbine's tower under water.

Figure 21 **Danish wind power engineering**



6.8. Financial services in the City of London

6.8.1. The sector and its historical development

The financial services sector has experienced rapid growth across Europe over recent decades and, in 2008, its near collapse as the banking crisis unfolded. The effects of the economic crisis were especially marked in the UK which, compared with most other EU countries, has developed a particularly strong base in the sector. Employment in the UK is second highest in the EU (with around 1 million employees) after Germany (which has around 1.1 million). In the UK, the sector has the highest level of gross value added per head of any industry (GBP 100 000 in 2009) with average remuneration around GBP 40 000 per person. The average level of remuneration disguises huge differences in incomes with many workers in the City of London in receipt of large bonuses each year.

The sector consists of banking insurance and asset management (a small segment of the sector but one with exceedingly high profit margins). It also comprises retail activities (services to individuals and small and medium-sized enterprises) and wholesale ones (provision of financial services to large corporations and other financial service organisations and government/public sector). Banking is the largest segment (59% of output) and has accounted for much of the growth over the past 15 years. Around 15% of all GVA (gross value added) is generated in London where the wholesale banking segment is pre-eminent.

In many respects financial services cannot be looked at in isolation from the supply of business services which are closely allied to the sector. The strength of London is the close inter-relationship between financial service institutions — especially wholesale ones — and the provision of a range of business services (such as legal services).

6.8.1.1. *The City of London cluster*

The financial services sector in the City of London dates back to the 12th century; today it is arguably the world leader. However, there have been periods when its future has been in doubt. For some, the present position of the City owes it success to the ‘big bang’ in 1986 which involved a major rolling back of regulation and resulted in many of the then leading US merchant banks moving to London. This brought about a major injection of capital and skills. With the creation of the Eurozone, and Frankfurt becoming mainland Europe’s leading financial centre, there were concerns that the sector in London would be overtaken, but this has not been the case due to the capacity of London to engage in market-making and the primacy of English as the language of business.

Currently, employment in the financial services cluster in London is around 315 000 (2009) a percentage change of -10% from one year earlier resulting from the fallout from the financial crash in 2008. For some commentators this is a temporary blip, with employment expected to grow over the long term. Financial and business services account for nearly two thirds of employment in the City of London and the adjoining Canary Wharf compared with around 6% in the rest of the UK.

6.8.1.2. *Benefits of agglomeration*

The principal benefit many employers in financial services report from being situated in the City of London is easy access to a large pool of highly skilled and qualified labour, as well as the close proximity of other organisations in the financial services supply chain. As the demand for space has increased, many of the larger organisations have moved back-office activities outside of the City to other areas, including some abroad. Hence the area has become more highly specialised in high value-added activities, even though the original concentration in the 'square mile' has pushed out towards Canary Wharf to the east.

6.8.1.3. *Costs of agglomeration*

The reliance on the financial services sector has created congestion problems; high office rents (notwithstanding the economic crisis in 2008) and skill shortages.

There are also concerns that the dominance of the financial services sector in the UK economy — it accounts for around 15% of GDP — has resulted in the sector proving attractive to those with high level quantitative skills who are in demand in other sectors of the economy. The national skills audits conducted in 2010, with the aim of identifying sectors which might provide either high economic growth or high employment growth in the future, found that these sectors were highly dependent upon the same types of skills which were also in demand in the City of London.

The relatively high wage levels on offer in the City result in it being more able to attract highly skilled individuals typically qualified in science, technology, engineering, and mathematics subjects.

The second problem which the City of London faces is over-agglomeration. This is potentially a constraint on output and development which results in sub-optimal economic development of the sector. The available data, however, suggest that major financial institutions want to be located close to one another to foster the culture of deal-making. The costs of over-agglomeration may well be one of the prices the sector is willing to pay to be located in London.

6.8.2. Organisation of VET

There is little doubt that the sector as a whole has a strong demand for higher level skills as indicated by the relatively high share of people employed in higher level occupations: 55% in London compared with 44% in the country as a whole (Table 33).

Table 33 **Occupational structure of London**

	London (%)	United Kingdom (%)
Soc 2000 major group 1-3	54.7	44.2
1. Managers and senior officials	17.3	15.6
2. Professional occupations	18.2	13.8
3. Associate professional and technical	18.8	14.6
Soc 2000 major group 4-5	18.2	21.6
4. Administrative and secretarial	10.9	11.0
5. Skilled trades occupations	7.2	10.5
Soc 2000 major group 6-7	14.2	16.3
6. Personal service occupations	7.5	8.9
7. Sales and customer service occupations	6.6	7.4
Soc 2000 major group 8-9	12.8	17.8
8. Process plant and machine operatives	4.2	6.7
9. Elementary occupations	8.6	11.0

Evidence suggests that employers in the financial services cluster struggle to find the skills they require. There is a tendency to take on generalists into financial roles, but there are many activities which require people qualified in specific disciplines. The leading players tend to concentrate their recruitment around high ranking universities. There is also much recruitment from abroad, with some employers reporting that graduates from abroad have a better range of skills.

Overall, the evidence points to skill shortages being commonplace across the cluster. Although the incidence of skill shortages may well reflect the pace of progress in the sector ,insofar as the supply side struggles to keep pace with the demand side, it nonetheless has an impact on production, including:

(a) delays in introducing new working practices;
(b) delays in introducing new products and services;
(c) increased outsourcing;
(d) wage inflation.

Some sectors of the market have experienced rapid wage increases over recent years. In the insurance sector, salaries rose by 64% in nominal terms between 1999 and 2007.

6.8.3. Skills management

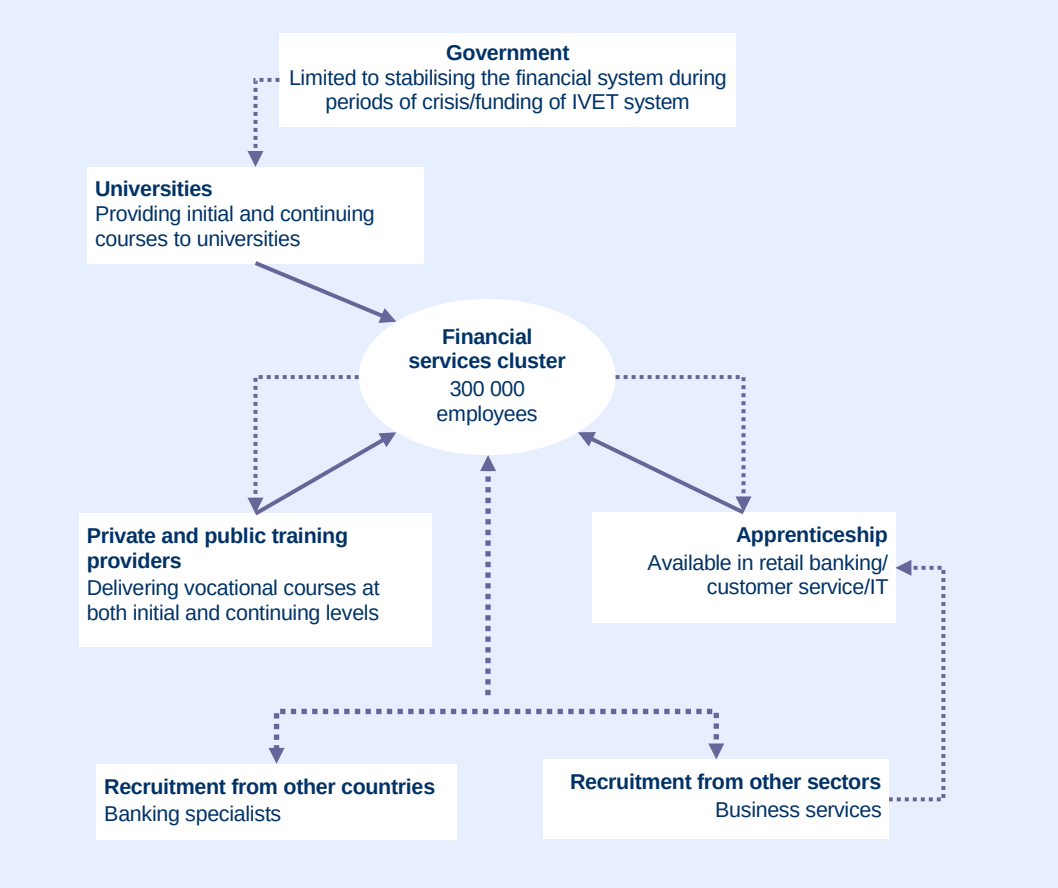
Private training companies have developed to serve the highly specialised nature of the employers in the financial services sector; several universities — many of them rank highly in the international league tables — also provide a range of training courses. There are concerns that the training market is not mature in some instances. A report which looked at the wholesale insurance sub-sector suggested that the absence of large corporate players in the sector resulted in limited provision of training; where it was provided, it tended to be informal.

There is also a tradition of providing apprenticeships for jobs at intermediate level in the financial services sector. These courses are part funded by the State — which meets many of the direct training costs — and by the employer.

The general impression is that there is little collaborative working through networks — as found in the other sectors reviewed in this chapter — through which knowledge might be shared. While several organisations provide networks among companies — many of which have a long history — the nature of working relationships in the sector is often competitive rather than collaborative. This is especially so with reference to the recruitment of skilled labour where there is much competition among companies.

Evidence suggests that the financial services sector is different from the others in this chapter. While the nature of activities in the City of London represents a cluster, there is, in practice, relatively little networked sharing of knowledge among organisations. In fact, knowledge is regarded as a commodity to be traded rather than to be shared freely as found in the medical technology or hi-tech manufacturing sectors described above. Firms compete to recruit and retain highly skilled employees, bringing about a degree of dysfunction in the market insofar and resultant wage inflation.

Figure 22 **Training in the financial services sector**



6.9. Hi-tech manufacturing in south east Brabant

6.9.1. Historical evolution of the region

Brainport is a technology cluster located in the south east of the Netherlands in the region of South East Brabant. It stretches over an area of 14 000 square kilometres in and around the triangle of Eindhoven, Leuven (Belgium) and Aachen (Germany). Along with Rotterdam's seaport and Amsterdam's airport it is one of the cornerstones of the Dutch economy ([38]).

Philips is the historical anchor of Brainport which was founded in 1891 in Eindhoven. Due to its success with electric light bulbs, Eindhoven grew up to be the largest technology centre in the Netherlands. The Dutch car and truck manufacturer DAF drove the economic upswing in the region in the 1930s (Kooperation international, 2010). New companies have been attracted by the

([38]) http://www.brainport.nl/en.

region's reputation for high-tech activities and parts of Philips became independent, including ASML (manufacturer of semiconductors) and FEI (high performance Linux systems). In 1965 Eindhoven University of Technology (TU Eindhoven) was founded and contributed to the economic development.

In the early 1990s, the Eindhoven region was hit by a severe economic crisis resulting in 36 000 job losses out of a total of 110 000. Philips, DAF Trucks and many of their suppliers were badly affected. To solve these economic difficulties, private and public sectors cooperated and jointly set up a 'stimulation fund', which can be seen as the root of what is, today, called Brainport. This joint approach — today also called the 'triple helix' to reflect the cooperation between trade and industry, education and training institutions, and local government — has focused on companies sharing knowledge and facilities to bring innovation and knowledge to the market. This has proved helpful in the face of the latest severe economic and financial crisis to affect the area (Van Gijzel, 2011; Brainport Foundation, 2009).

Two technology campuses at Brainport facilitate technology and knowledge transfer across the region: the High Tech Automotive Campus and the High Tech Campus Eindhoven. The latter was founded by Philips in 1998 to concentrate all its R&D activities in one location. This concentration of high-end knowledge added to the interaction among researchers in different disciplines. As common knowledge-sharing at the campus increased innovative capacity, Philips decided to open up the campus to other technology firms in 2003. Numerous innovative companies joined the R&D campus, as 'pre-competitive cooperation in open innovation' has proved to be a successful way to maintain competitiveness (High Tech Campus Eindhoven, 2010). About 90 companies and 8 000 researchers work together on this campus for developing new technologies and products ([39]).

Today, Brainport is one of Europe's top technology areas and describes itself as an open innovation eco-system. There are more than 50 000 companies and the leading sectors are high tech systems and materials, food science, automotive, biosciences, and design. The Eindhoven region, which is at the heart of Brainport, comprises 21 municipalities, 730 000 inhabitants and a workforce of 400 000. Around 70 000 jobs are in high-tech, automotive and manufacturing industries. The average GDP per capital equals EUR 36 000, slightly higher than the Netherlands GDP per capita of EUR 35 600 in 2010. More than one third (36%) of private R&D expenditures in the Netherlands are spent in Brainport, which is equivalent to 1% of the Dutch GDP in 2008. Brainport spends 8% of its gross regional product on R&D; 52% of all Dutch patents come from here and the

([39]) http://www.brainport.nl/en.

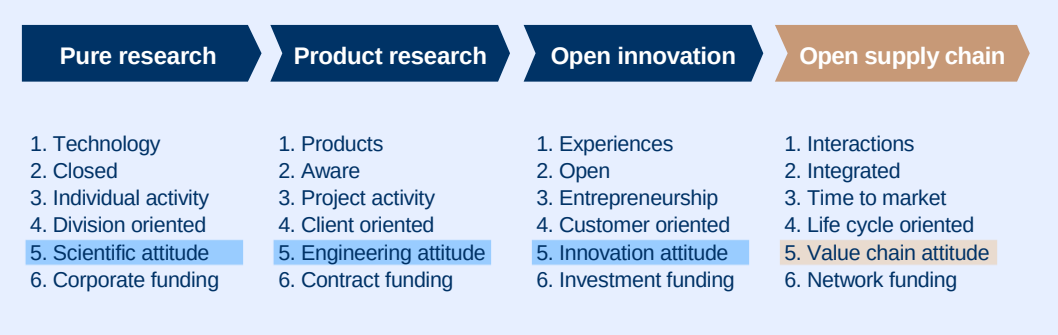
region is in the top three of Europe's regions ranked by patent density (Brainport Foundation, 2010).

6.9.2. Organisation of VET

6.9.2.1. *Research and development strategies*

The R&D strategy was certainly influenced by Philips global strategy to concentrate its R&D activities at Eindhoven which, in turn, attracted other research-oriented organisations. Over the years the region's approach to research changed (Figure 23): in the 1980s the region was concentrated on pure research activities which relied on individual activities, whereas in the 1990s the focus moved towards product research. This was more client-oriented and funded by single contracts rather than corporate funding. In 2000 the approach changed once more, to an 'open innovation eco-system' with a much stronger customer-orientation (Brainport Foundation, 2010).

Figure 23 **Brainport development strategy**



Source: Brainport Foundation, 2010.

This significantly changed the skill needs of Brainport from professional scientists and engineers in the 1980s and 1990s to creative and flexible technical specialists. Business administration and entrepreneurship became important over the last decade and will be even more so in the future. Brainport envisages the optimisation of (global) value chains as the key task of specialists. Interaction and integration will become more important and the efficiency of networks will be highly relevant for both production and obtaining financing.

Brainport companies are subject to competition from low cost countries and there is recognition that the relocation of production might also lead to the relocation of R&D activities in its wake. To avoid these developments, Brainport has set up strong collaborative networks among companies and knowledge institutions. There is also a strong public sector knowledge infrastructure.

Complex and short production development paths are necessary to defend a competitive position in the market; Brainport companies often pursue the strategy of developing high-class products in small volumes. When new products are introduced it is common for the first 100 000 products to be manufactured in Brainport, to guarantee quality standards, with (mass) production later relocated to eastern Europe, south Asia or Brazil (source: expert interviews).

Brainport 2020, the agenda of collaboration, focuses on the domains 'people', 'technology', 'business' and 'basics' to improve the competitiveness of the region. Brainport aims to be among the top three of Europe's technology regions (it is currently number nine), with economic growth of 3%, double the national average, resulting in near full employment.

The aim is to retain the open innovation approach, which is seen as one of the main strengths of the region. A strong public R&D infrastructure is seen as vital to product development, export growth, and attractiveness of the region to other businesses (Brainport Development, 2011).

6.9.2.2. *Training strategies*

To keep the Southeast Netherlands internationally competitive, high quality education, at every level, which meets the needs of companies is necessary. Attracting domestic and foreign engineering and entrepreneurial talents is the aim. 'Knowledge workers and skilled workers are needed because without them thousands of vacancies will remain unfilled. The flexible job market of 2020 will provide work for young and old, men and women, and every kind of job-seeker' (Brainport Development, 2011).

The previous strategy *Brainport navigator 2013, beyond Lisbon*, formulated in 2005, focused on further developing knowledge-intensive manufacturing in the Brainport region. Regarding education the aim was to develop a 'Brainport-fit education system' (Brainport Eindhoven, 2006, p.17), which means a vocational and tertiary educational structure matching the regional need of the business community. More regional embedding of further and higher education is also targeted.

6.9.2.3. *Training institutions*

Brainport's education institutes contribute to the essential basis of a highly educated workforce in the region (Kooperation international, 2010).

The following R&D institutes are located in Brainport:

- Dutch Polymer Institute (DPI);
- Embedded Systems Institute (ESI);
- Holst Centre;

- TNO;
- TNO Automotive;
- TÜV Rheinland TNO Automotive International B.V. (TTAI);
- EDCO Eindhoven B.V.;
- FOM (energy research).

In 2005, 23% of total employment in the ELAT region — the triangle of Eindhoven, Leuven (Belgium) and Aachen (Germany) — were involved in R&D.

Around and in Brainport three important universities focus on engineering, economics and biomedical science: TU Eindhoven, University of Tilburg and the University of Maastricht. Brainport also benefits from surrounding universities, such as the University of Leuven, Belgium's largest with more than 30 000 students. About 100 kilometres away is the University RWTH Aachen, an important university of technology in Germany with more than 30 000 students (ELAT, 2008).

The four main education institutions in Brainport are:

(a) TU Eindhoven, a leading research university in engineering science and technology. It is in the top 10 of world's best-performing research universities in research cooperation with industry (up to 1 000 projects per year). TU Eindhoven has an important strategic role in Brainport as it creates relevant knowledge and educates high-tech knowledge workers. Nevertheless, the university is aware of the pressures to be among the top universities worldwide and to develop links with the emerging centres of knowledge and business, for example in China and India (TU Eindhoven, 2011). It had 7 118 students in 2009 and 3 131 employees (research staff, professors and PhD fellows) (TU Eindhoven, 2010);

(b) Fontys University of Applied Sciences was founded in 1996 and provides Bachelor courses in technology, economics, social work, health care and teacher training and Master programmes in management of IT, Master of information systems, and e-business. Courses are specifically geared towards the needs of industry as the training programme is determined in consultation with all stakeholders in the relevant professional sector. Fontys has around 36 000 students and 3 900 members of staff. It provides its courses in 35 separate schools ([40]);

(c) Regional Education Centre (ROC) Eindhoven provides secondary vocational education in Eindhoven, mainly in technical occupations. It has about 22 500 students and 1 500 members of staff. Courses are taught in 18 branch-

([40]) Fontys University of Applied Sciences (http://fontys.edu/).

specific secondary VET schools, one adult education school and one Montessori secondary school. Courses at ROC Eindhoven can be followed in two pathways which combine studying and working: the predominantly school-based or the predominantly work-based pathway. Courses are available at four different qualification levels ([41]). The most popular training professions are nurse; sports and movement; care and wellbeing; educational assistant; and middle management engineering;

(d) Design Academy Eindhoven is a renowned education institution for design and provides Bachelor and Master courses in Dutch and English. Its core areas are graphic design, trend specialists, city planners, interior architects and product design (Kooperation international, 2010). In 2009 the academy had 732 students (Design Academy Eindhoven, 2010).

Cooperation is seen as a crucial dimension of the Brainport network. For example, there is cooperation in disciplines among the three Dutch Universities of Technology (TU Eindhoven, Delft University of Technology and University of Twente) as well as national and international collaborative links between companies and knowledge institutes (Brainport Eindhoven, 2006).

Fontys University of Applied Science and ROC Eindhoven have a joint programme called 'know-how sharing' where students from Fontys and ROC build multidisciplinary teams and work on realistic knowledge- and innovation problems of companies in the Eindhoven region. This programme helps education institutions continuously to anticipate the needs of the industry for knowledge productivity ([42]).

6.9.3. Skills management

Specialisation in high-tech products, IT, design, etc., was based on more than the success of Philips. Over the time a large network, including education and knowledge institutions, developed in the region and contributed to the success of the cluster (Figure 24).

Education institutions significantly contribute to regional success as they deliver parts of the required workforce in Brainport: companies benefit from concentration of research activities and education programmes. TNO Automotive relocated from Delft to the Eindhoven region partly because TU Eindhoven was the only Dutch university which provided automotive education and research. This was important for TNO research activities (ELAT, 2008).

([41]) ROC Eindhoven web site: http://www.roceindhoven.nl/.

([42]) http://www.fontys.nl/elektrotechniek/ipd/knowhowsharing.

Human capital is a main asset for competitiveness and for many large companies one of the biggest challenges is to obtain a sufficient number of suitable employees (source: expert interviews). However, regional education institutions cannot meet the employment needs of Brainport companies. An OECD analysis (2007) saw strong potential in the high-tech cluster, but it also pointed out that problems of regional attractiveness have to be solved and an adequate labour supply has to be guaranteed.

Brainport reacts to these challenges and tries to attract more students and employees. It has learned that it is necessary to provide a 'Brainport career' across different companies or even sectors. To aid labour mobility within Brainport, the electronic platform or 'e-portfolio' was introduced, where employees register all their competencies (formal and informal) (source: expert interview). In addition, education institutions try to attract more Dutch and international students (many courses are provided in English) and to improve the image of disciplines like mechanics, physics and chemistry (source: expert interview). Cooperation between companies and education institutions goes beyond exchanging views with academics often working for both companies and universities. Thus they are familiar with skills needs of companies.

Education institutions are indispensable for innovation in Brainport. There are proximity effects between education institutions and companies and cooperation is necessary for innovation research. For example, ASML, a manufacturer in the semiconductor industry, stopped its cooperation with the Massachusetts Institute of Technology due to this lack of proximity (source: expert interview). In R&D, there is a global trend that companies increasingly subcontract application-oriented research to universities. In this context, Brainport benefits from education institutions and research campuses in the region.

Innovation is also promoted by cross-sectoral cooperation: for example the automotive sector benefits from proximity with ICT companies with respect to the introduction of informatics in automobiles. Another example is the MRI scanner of Philips Healthcare which is used in hospitals; one reason for its popularity is its design and customer friendliness. This was achieved as Philips developed the scanner in cooperation with the Design Academy Eindhoven (source: expert interview).

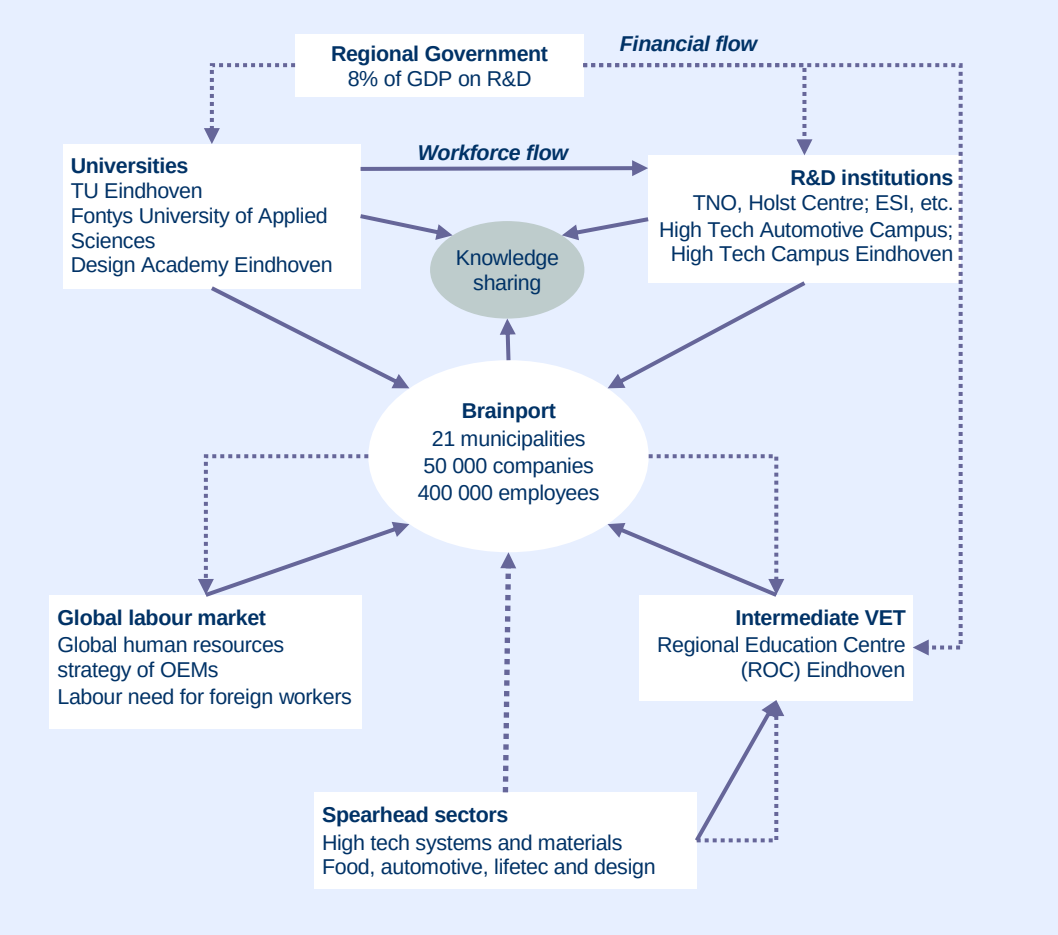
Brainport sees the importance of a sound employment market to a functioning innovation eco-system and so invests in customised education (Brainport Development, 2010). To achieve this goal, companies, education institutions and municipalities need to cooperate. Achieving a balance creates several potential tensions, especially that of ensuring that education institutions do not end up becoming subcontractors to business.

It is larger companies in the supply chain (typically companies with up to 600 employees and an average turnover of EUR 200 million) which play a more important role in regional labour market development than the large original equipment manufacturers (OEM) such as Philips Healthcare, ASML, or DAF Trucks. OEMs, in particular Philips and DAF, played an important role in the historical development of Brainport and there is a cluster of Philips firms today due to several company spin-offs such as ASML and NXP. OEMs are large, global companies with their own global human resources strategies, which only contribute to regional labour market development to a certain degree, but these large companies strongly depend on the inflow of employees from the region and have to be involved in regional labour market developments. They also act as role models for smaller companies (source: expert interview).

The case of Brainport appears to be an excellent example of development towards a knowledge-intensive economy. It reveals that human capital investments are at the centre of such a development strategy, but they are highly dependent on economic and social conditions, on one hand, and the type of knowledge management on the other.

From the beginning, Brainport focused on high-tech engineering, supported by local universities and training institutions. But the supply of professional engineers and scientists has been far from sufficient. During the first phase, a dominant international company — Phillips — was the engine of economic growth. Later, the importance of the big player was reduced and several other large companies came in and provided alternative business-related competences in the emerging network. As a result of globalisation, production-related activities declined; maximising value in the organisation of production became more important.

Figure 24 **Brainport cluster**



The key to the success of the regional development strategy, however, was provided by knowledge management, i.e. the way in which innovation was organised within the large network of specialised companies. It became clear that knowledge sharing between specialist and other companies provides better results than knowledge protection. The combination and cooperation of firms with different specialisms strengthens the competence profile of all partners and fosters innovation. Also, the risk of poaching among partners decreases and positive specialisation effects appear.

Brainport demonstrates the importance of networking for a successful knowledge-based economy, and points to the fact that human capital investments are only productive if the organisation of work and cooperation are effective.

6.10. Conclusion

The five cases presented above demonstrate a series of key issues for the assessment of human capital in the process of economic development:

(a) for all five sectors, highly skilled labour is the main input for growth and competiveness. Firms, governments and workers undertake considerable efforts to supply the skills needed for high quality production, the efficiency of operations, and for innovation;

(b) training investments are pivotal in restructuring processes. Human capital investments are not restricted to supporting the expansion of growth industries. In declining industries, such as textiles or shipbuilding, the available skills are adapted and transformed into new occupations to establish the knowledge base for more productive activities. Training, therefore, is the key investment for the reallocation of labour into the growth industries;

(c) in all five regions, the specialisation patterns are deeply rooted in the historical tradition of the local or regional labour markets. The high degree of innovation which can be observed in all cases seems not to be achievable without the long-term accumulation of professional knowledge in the local labour markets. The value chain thus has a third, time-based, dimension, in addition to the horizontal and vertical links, and training systems play a pivotal role in organising this knowledge transfer over time;

(d) production structures are strongly determined by the provision of skills in local labour markets. This is not only true for the prominent case of German manufacturing, which became stronger on the basis of its capacities in engineering and intermediate production. There are also the financial experts in the City of London who attracted financial institutions from all over the world, and there is the Danish wind power expertise which attracted even Chinese and Indian companies into Denmark. These observations point to the key role of human capital investment which is at the very beginning of economic restructuring and development.

The way skills supply is achieved is different in the five cases. The City of London provides a market based approach with mainly private training investments by trainees and employees. The London financial services market is essentially one characterised by high levels of skill shortage and high levels of competition among firms to attract highly skilled workers, and high levels of competition among major players to capture markets. Compared to other sectors, fewer institutions attempt to foster cooperation or networking among organisations where there may be some form of knowledge exchange. Under

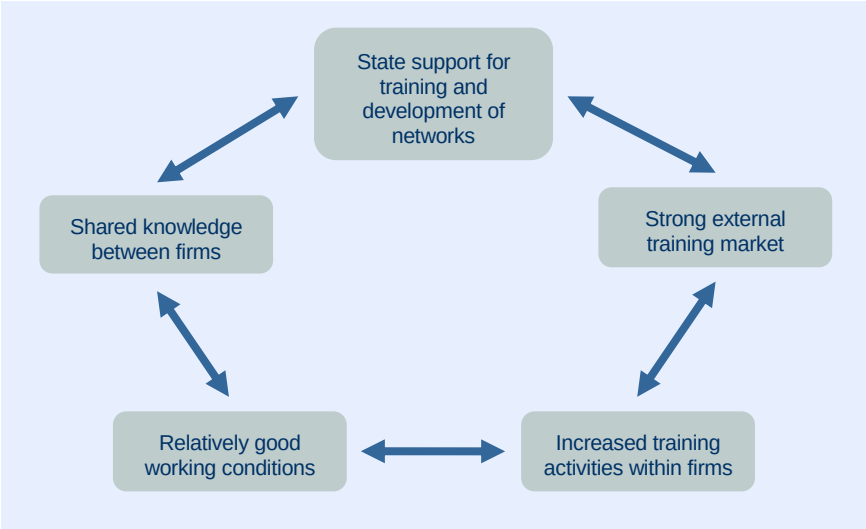
these conditions, human capital has the character of private capital owned by the employees, and used by the companies for the duration of the labour contract, rather than having the character of a public good. The implications can be seen in the case study: the lack of local skills supply forced companies to recruit from abroad. The risk of poaching resulted in high wage increases, even exceedingly high wage increases if the bonus payments of senior staff are considered. This is in contrast to the other cases where the local alliances for training and development organised the skills supply at local level and where wage growth appears to be much more moderate. This leads to the conclusion that skills shortages in competitive local labour markets are in favour of workers' incomes, while skills shortages in cooperative labour markets — at least in the short-term — are in favour of company development. Over the longer term, however, the cooperative approach may provide both employers and employees with more sustained benefits in selected sectors.

In the financial services sector the industry is, to some extent, self-contained in terms of production; it prefers its own pool of specialists which does not need to be shared with other sectors and whose productivity does not depend on upstream and downstream linkages. This is very different to manufacturing sectors. The importance of training alliances, therefore, is not so evident. The more integrated value chains in other sectors and regions had to apply a cooperative approach; also, cooperative approaches belong to the traditional knowledge base in continental Europe. The case studies illustrate the way in which training can be increased through knowledge-sharing networks, which provides both informal and formal training. The typical configuration of such a system appears to be as outlined in Figure 25 below. There is a combination of State support (from either national or regional government) for the provision of an infrastructure where firms can exchange knowledge, a strong external labour market capable of supplying the skills firms require, a commitment from firms to engage in training, and networking among companies.

The commitment from firms to train is essentially driven by the commitment to obtain and sustain relatively high value-added positions in the market. A further feature is the need to create a stable working environment. This might not necessarily be reflected in high levels of job retention within individual companies but is based on high levels of labour retention within the cluster or network. If there is high labour turnover, coupled to skill shortages, then the social contract within the network will tend to breakdown: employers will seek to retain their own staff and prevent them, as far as possible, leaving to join other companies. This tends to run against the underlying factors which allow the sectors to maintain a degree of knowledge sharing (as in the Financial Services cluster in London).

Labour retention tends to be driven by providing employees with a package of human resource practices which discourage people from wanting to leave the company (or the sector). Hence, Figure 25 emphasises the importance of good working conditions prevailing across the sector as a whole. Moreover, it indicates that the fuelling of training investments by public support helps by reducing the costs of poaching as this keeps the supply of skilled labour in external labour markets at sufficiently high levels.

Figure 25 **Characteristics of knowledge exchange within sectors**



Traditionally, the discussion about HPWPs tended to focus on activities within individual firms. The extent to which consideration has been given to high performance working at sectoral level tends to be simply that of looking, in aggregate, at the activities of individual companies. Such an approach will show that sectors, such as financial services, exhibit many of the features associated with high performance working. Yet, there is also a need to look at the degree of cooperation and coordination of activities at sectoral level — the interplay between R&D, training, and good working practices — which has the capacity to deliver a return beyond the private one to an individual company. Hence several of the sectoral case studies have been able to reinvigorate their industrial base, sometimes in declining businesses, through concerted actions. If attention is focused again on Figure 25, cooperation through concerted sectoral actions has allowed sectors (certainly where they are geographically concentrated) to make a transition from being mature industries in long-term employment decline to more dynamic new industries. This has been achieved through the provision of, in many instances, a (partially) publicly-funded infrastructure which provides both

R&D and training support. But, if such an approach is to be successful, there needs to be a set of working practices which are consistent with operating in new, dynamic sectors of the economy where companies and sectors are trading on their relative knowledge base. As noted in the case studies, because these sectors are, in many respects, at the frontier of new product and service developments within their sector, they are subject to skill shortages simply because the supply side is constantly trying to keep pace with rapidly changing demand. Also, many of the core competences required are in demand from other sectors. The cooperative approach ensures that the skills and knowledge available to the sector are optimally deployed within the sector without spiralling wage increases — except possibly in financial services — or people being attracted to other sectors in the economy with a demand for these skills. The evidence points to working conditions being one of the factors which have allowed the sectors to attract and retain skills within the respective sectors or clusters.

Overall, there is evidence of mimetic behaviour within sectors as individual companies learn from one another; this creates new social norms within the sector. As noted in the examples of Brainport and Baden-Württemberg, companies seek to relocate some of their activities to these clusters to take advantage of the knowledge pool available. They succeed only if they are willing to engage with existing practice in those clusters. At the same time, technology or sectoral specificities impose some constraints on behaviour at sectoral level. Arguably, the specific nature of the relationships among organisations in the financial services sector — which is more oriented towards competition rather than collaboration — suggests that the cooperative approach to obtaining increased social benefits from engaging in VET is not necessarily transferable to all sectors.

The voice of social partnerships is relatively muted across all of the sector-clusters reviewed above. The social partners are represented on various VET bodies, and are broadly supportive of the direction of travel in most of the sector-clusters, but the principal player in bringing about a cooperative approach is the State in providing a range of institutions and funding which acts as a catalyst for developments to take place within the private sector.

CHAPTER 7.

Conclusion and recommendations

7.1. The policy challenge

As the European commission (2008) pointed out, the interest of policy-makers in job quality has fluctuated over recent decades, partly reflecting macroeconomic conditions resulting in policy-makers being more attuned at various times to the quantity, rather than the quality, of jobs. Quality and quantity are not mutually exclusive and may, in principle, in the guise of high performance workplaces, be mutually reinforcing. There is, as always, a demand for evidence that improving the quality of work will in some way generate a positive economic return, as if the goal of good working conditions was not a laudable one in itself.

7.2. The relationship between job satisfaction, training, and productivity

To begin, it is worth confirming that the present results suggest a strong and easily interpretable relationship between job satisfaction and 'good' working conditions. The multi-dimensional measures of job quality available to the present study contain various measures relating to skill development (although other HPWPs-type variables have also been included in the econometric models). The theoretical justification for doing so is that employer provided training, and the opportunity for other forms of skills development, may be viewed as a 'gift' from the employer.

Do the empirical results outlined in Chapter 4 indicate that the 'gift' of training is viewed positively by individuals and, if so, is this positive attitude maintained across all sectors? The answer is slightly more complicated than yes or no. The general pattern, both overall and across most sectors, is that low levels of training (e.g. fewer training days) are less valued than higher levels of training.

This initial low or negative impact of training at low levels of training days, may reflect a range of factors: the type of training associated with small numbers of days; the initially disruptive effects of training on work or home life; worries that individuals have about training (e.g. their ability to succeed in acquiring the skills), which may be assuaged as training progresses. The evidence is highly supportive that the effects of training on job satisfaction across most sectors

increases with the number of training days, although at a diminishing rate, and those that start with negative satisfaction when training days are low become positive as training days increase. Thus, the shape of the training days/job satisfaction curve for most sectors is consistent with the idea that satisfaction increases with the number of training days, but each additional day of training adds less to satisfaction than the previous day. Even where this is not the case, for almost every sector, there is some number of training days that give rise to positive satisfaction for the employees.

The question then arises as to whether each sector provides sufficient days of training to ensure positive satisfaction among workers? Sectors are more likely to provide levels of training leading to positive levels of satisfaction if there is a feedback from satisfaction to individual motivation and commitment and, thereby, to organisational performance. Firms that offer training above the average for the sector will offer positive satisfaction; this will also be true of sectors where the level of satisfaction is marginally negative at the average number of training days, if the number of days offered is sufficiently large. If true, it suggests that individuals may base their satisfaction on whether their employer is 'better than average' in terms of their funding of training. The sectoral rankings of satisfaction simply follow the number of training days offered (Table 2), for example, 'publishing, printing and reproduction, etc.' ranks most highly and 'manufacture of furniture or recycling' is lowest ranked.

The results give some support for the conceptual idea that training may be part of a 'gift exchange' process with a sectoral dimension. This is unlikely to be an income effect; conceptually, employer provided training may have a higher firm-specific content, but also, empirically, income is controlled for, at least in the final estimates. It seems more likely that this 'gift' operates in other ways: it helps to equip workers for the job and it may move them from having too few skills for their current tasks to having skills that match their current job requirements, which the empirical results have shown to be an important influence on job satisfaction. It may also provide individuals with an element of job security insofar as it equips them with the means to adapt to structural change in the workplace or labour market more generally.

So, if the opportunities for skills development, including training, are offered as part of a 'gift exchange', what is the evidence that increased job satisfaction increases organisational performance? There is a considerable overlap between the type of working conditions variables considered in the present study and those which appear in the HPWPs literature, which focuses on the effects of such work practices mainly on company performance (e.g. profitability or market value). While, on balance, empirical literature tends to be positive about the role

of HPWPs, there are important differences among reported returns on various practices (which is hardly surprising given sectoral and other differences).

Perhaps more important, there is a general acknowledgement of the lack of adoption of such practices (Bosworth, 2005; Bosworth and Stanfield, 2009). According to Tamkin et al. (2008, p. viii), the take-up of HPWPs has been slow and many organisations have not adopted them. The authors argue that, 'the doubts of practitioners reflect concerns over what it might mean for individual firms and sectors, and confusion over which people management practices are likely to show the greatest link to performance. Many studies adopt complex measures which are outside the capabilities of most firms to replicate. What is needed as a step change in employer behaviour are measures that have been linked to performance, that employers can capture for themselves and which do not require considerable academic resource to make useful.' (Tamkin et al., p. viii).

While these may be the reasons for the slow and 'inadequate' take-up of HPWPs, there may be another explanation, which is explored here in the context of the skill development variables. The hypothesis is that, of the skill development variables, some may have a positive impact on job satisfaction and some may have a positive impact on productivity. The result is that some working conditions (in our case, skill development activities) that increase satisfaction and raise productivity are more easily introduced than others.

The final element of the investigation of the 'gift exchange' model rested on the hypothesis that there may be some degree of relationship between the size of the 'gift' and both parties (e.g. employees and employers). This was considered at sectoral level, by comparing the magnitude of the contribution of training to individual satisfaction at sector level and the magnitude of its contribution to productivity performance of the sectors. Several reasons were put forward as to why this relationship may be far from clear cut, for example, a satisfaction-productivity 'gift exchange' is only one factor influencing productivity performance.

The examination of this relationship across sectors suggested that there was a significant similarity in the ranking of sectors by the contribution of training to job satisfaction and the contribution of training to productivity growth.

Table 34 Ranking of selected sectors according to the contribution of training to productivity and job satisfaction (high rank sectors)

	Rank	
	Productivity	**Satisfaction**
Mining and quarrying	1	2
Water transport; air transport; etc.	2	3
Public administration and defence; etc.	6	7
Health and social work	9	11

The relationship is imperfect, but the Spearman rank correlation is still 0.33. The results suggest that very few sectors reduce the correlation significantly (e.g. agriculture, with a difference in rank of 19; and Manufacture of food, etc. with a difference in rank of 18).

Table 35 High and low rank sectors

	Rank	
	Productivity	**Satisfaction**
Mining and quarrying	1	1
Water transport; air transport; etc.	2	2
Public administration and defence; etc.	6	5
Health and social work	11	9
…..		
Real estate activities	16	15
Land transport	17	17
Manufacture of furniture or recycling	19	20
Wholesale and retail trade; repair of motors etc.	20	19

While not every change is for the better, the rankings tend to tighten up considerably, and the rank correlation rises to 0.55. It raises the question as to whether agriculture, etc., and the manufacture of food, etc., have some special features which make them outliers (and the rank correlation is relatively high) or whether the 'gift exchange' model is somewhat weaker in its explanation of the employer-funded training/job satisfaction/productivity outcome (and the rank correlation is somewhat lower).

These results raise also the question as to whether anything can be done to bring the outcomes of sectoral job satisfaction and productivity into line. Do firms in each sector understand the underlying shape of the employer provided training/satisfaction relationship or the types of training that give rise to higher levels of training for employees? If, for example, employers know that a short burst of training of, say less than five days, gives rise to negative employee satisfaction, they might benefit directly by increasing training to eight or 10 days; this increases the motivation and commitment of the employees, both to the

success of the training and the productivity performance of the firm. Can on-the-job training, which is already viewed positively by employees and employers (but not significantly so in the case of employees) be modified so that both parties are significantly positive about it?

7.3. Results from the sector case studies

The estimated residual sectoral effects in the econometric modelling reveal an effect at sectoral level with respect to job satisfaction and access to training which is not accounted for by any of the variables in the model. A series of sectoral case studies were undertaken to explore further the way in which sectoral effects might work. These were of relatively high value, high skill, geographically concentrated sectoral clusters:

(a) medical technologies in Baden-Württemberg, Germany;
(b) advanced (automotive related) manufacturing in Brainport, the Netherlands;
(c) advanced textiles manufacturing in Flanders, Belgium;
(d) renewable energies, Denmark;
(e) financial services in London, UK.

The sector case studies were designed to supplement the econometric results. They illustrated the spillover effects among workplaces within a sector where there is a concerted attempt to increase the stock of human capital through collective training activities. Evidence from the case studies reveals that strong economic performance has been predicated on developing a social contract which places a strong emphasis on relatively good working conditions across sectors (which minimises the amount of movement by employees among employers since there are limited economic gains from doing so), coupled to high levels of innovation and collaborative working among employers. Relatively good working conditions refer to those working practices which emphasise the importance of worker autonomy, teamwork, relatively flat hierarchical management structures, and flexible working arrangements. It is this mix of factors which assists companies to remain at the forefront of the sectors in which they operate.

The sector studies also suggest that sectors have a lifecycle (as outlined in Figure 17) where they become increasingly dependent on knowledge production. The initial development of an idea resulting in the production of low volume, high value goods and services over time, will give way to a process whereby the product becomes increasingly commodified and subject to a shift in its production, and employment, to lower labour cost countries allied to use of mass

production systems. Sector-cluster-regional configurations have effectively allowed sectors to reinvent themselves as they have adapted to decline in their traditional markets. The examples of the Brainport hi-tech cluster, the Flanders high-value textiles sector, the Baden-Württemberg medical technologies cluster, and the wind power engineering sector in Denmark (described in Chapter 6) are all examples that sector restructuring is closely related to the historical accumulation of skills. Implicit in the reinvention of these sectors is the development of working practices which are conducive to sharing knowledge among organisations and over long time periods. Education and training institutions play a pivotal role in this process of knowledge transfer over the time axes.

There are also a range of sectoral specific factors. High performance sectors rely on a strong supply of skills from the external labour market and from within the organisation. While wages play an important part in retaining people with these skills in the business, there are also a range of other, non-remunerative policies which assist with the retention goal. The econometric evidence points to the importance of employees having aspirations which are at least partially satisfied through the provision of training and other forms of skill development. In sectors where strong inter-firm networks have been established, the provision of professional development and training by those other firms is often highly visible. Hence organisations within the sector cannot afford to deny their workforce access to training and a range of other social goods which are readily available elsewhere.

7.4. Conclusions

Training has a significant positive impact on workers' satisfaction with their jobs when integrated in human resource policies. There is also a correlation between the effect of training on job satisfaction and on productivity growth: sectors in which the impact of training on job satisfaction is largest, tend to be the ones in which the impact of training on productivity growth is also large.

The way these benefits accrue to firms and workers are different, depending on various sector characteristics.

In sectors characterised by strong market-oriented competition among firms (e.g. the financial services sector), it is in the workforce's interest to invest in training. The returns on this investment depend on the workforce's ability to elicit wage offers from different firms. In such sectors strong competition among firms for highly skilled labour drives up wages. But in this type of sectoral environment

poaching is accepted as one of the rules of the game, so firms are reluctant to invest in training and avoid potential skill shortages by recruiting from abroad.

Under a different model the returns to training accrue in a more cooperative environment. The role of the public sector is to act as a catalyst to bring about knowledge-sharing among firms, and provide an infrastructure within which this can take place. This includes the provision of workforce training. Social partnership is key in this model. The cooperative approach provides a natural cradle for the successful development of an industrial cluster. The role of training institutions — both publicly and privately funded — play a vital role in the in spreading and sharing of knowledge across the industrial cluster. They also ensure that a supply of skilled workers is available. Workers may not stay with the employer who trained them, but, evidence points to them being retained within the industrial cluster. This is especially so where firms in the cluster cooperate through inter-firm networks which include the provision of training. There is much less evidence of active poaching in this type of environment because the success of the approach is based on cooperation among firms.

The evidence points to the cooperative model of training, in which training is integrated into the broad human resource practices of firms, succeeding in different sectoral contexts.

In mature sectors, where routine operations have been transferred to low-labour cost countries, there is a need to ensure that the core jobs which remain — e.g. strategic management, problem-solving, research and development, niche/small-scale manufacturing — are retained within the industrial cluster. The evidence from the textiles cluster in Flanders and the hi-tech manufacturing in Brainport in the Netherlands, points to the cooperative approach to the professional development and training of the workforce being instrumental in the successful development of these clusters.

In sectors where there is still significant employment growth potential, the cooperative model has successfully ensured that skilled workers have been able to transfer into the cluster — through the provision of training as required — from other sectors, and retained and developed within the cluster. This is often important where a large part of the cluster comprises SMEs which are sometimes more constrained in the amount of training they can provide compared to their larger counterparts. Evidence from the Wind Power cluster in Denmark and the Medical technologies cluster in Germany point to the success of the cooperative model in sectors which are still experiencing a relatively rapid pace of development.

Since firms within the cooperative model described above are geographically clustered, there are strong incentives for them to adopt similar approaches to

their human resource development practices lest they lose their highly skilled employees to other firms. Similarly, there are few incentives to engage in active poaching in the context of skills supply keeping pace with skill demand.

Market forces alone will tend to create cooperative environments at a too slow a pace, so there is a role for public sector agencies to act as catalysts by establishing appropriate training institutions within the wider context of developing inter-firm networks. Training by itself is not sufficient to bring about the successful development of an industrial cluster, but it is a vital and necessary ingredient and one where public sector agencies have a degree of leverage given the extent to which national VET systems are dependent on public funding. These policies are likely to be particularly successful where they look to develop further the skills which have been historically important in the areas where the industrial clusters are growing.

7.4.1. Recommendations

The key question is how to develop policies which will persuade employers to raise the quality of the working environment (including access to training). Despite the recent downturn in the EU economy, this time the policy interest in job quality has not diminished. The Agenda for new skills and jobs, for example, sets out several routes for bringing more people into employment, focusing on, '[...] better functioning and less segmented labour markets, a more skilled workforce, better job quality and working conditions, and the promotion of both job creation and labour demand' (European Commission, 2010). Better job quality and working conditions are writ large into this policy framework.

At sectoral level several observations can be made:

(a) there are constraints relating to certain aspects of working conditions (such as those which prevail in the production sector). To some extent wage levels are used to compensate for physically demanding working conditions;
(b) there are constraints on access to training and development insofar as some sectors are seen as inherently low-skilled with little demand for training and development;
(c) better information may be required at sectoral level about what forms of work organisation and working conditions employees value and how they might be introduced in ways that allow the greater employee commitment and motivation that results from their introduction to show through in terms of higher performance and productivity;
(d) in particular, there is fairly robust evidence that individuals value longer rather than shorter training programmes; choosing a length of programme that gives higher satisfaction in that sector as well as increased productivity

is likely to be more successful than a short programme to which recipients attach negative satisfaction;

(e) results from the sectoral case studies suggest that there can be spillovers among employers where there is concerted action by employers to raise skill levels. The provision of relatively good working conditions is the means used in the sector case studies to ensure that employees do not leave the employer or the sector to take up employment with better prospects elsewhere.

The sector studies draw attention to the role of labour-market institutions at sectoral level which foster inter-firm collaboration within sectors and clusters. There is a risk that the market will be slow to develop these institutions at sectoral level. The types of institutions which are found in the more successful sectoral industrial clusters allow for information about a wide range of issues to be shared and for organisations operating within the same markets, to learn from one another. One of the outcomes of firms working in a collaborative fashion across a sector is that employees are aware of the working conditions available elsewhere. This creates a virtuous circle whereby employers need actively to retain workers without resorting to inflationary wage increases, and employees in return need to repay any investment the company makes in them in order for the system to keep working. In other words, the benefits need to be shared. Industrial clusters are environments in which this naturally happens. The development of industrial clusters has a key role in the European regional growth and innovation strategies, as is clear from a snippet taken from the Europe Innova policy action, whereby it is explicitly recognised that: 'clusters are important eco-systems for the competitiveness of European enterprises as they offer a favourable business environment that stimulates innovation and growth. With the increasing recognition of clusters as drivers of economic and regional development, many cluster policies and cluster initiatives have been launched over the last decade to support existing clusters or the emergence of new clusters' ([43]).

The case studies summarised in this report clearly show that VET policies will play an important role in supporting existing clusters and in helping new clusters to emerge. For example, a recent study on the growth of 'green energy sectors' concluded that the general weakness of the EU skill base was a serious constraint on the capacity of the sector to grow (Cedefop 2010). Policy measures aimed at the development of industrial clusters based on renewable energy will also have to contain policy measure supporting VET to address the ensuing skill

([43]) Europe Innova: Cluster cooperation overview (http://www.europe-innova.eu/web/guest/cluster-cooperation/overview).

needs. This would bring about a direct impact of VET policy on productivity levels within the sector or industrial cluster: VET policy will contribute to higher productivity levels by improving the skill base. The present reports stresses that there will be also an indirect effect on productivity levels mediated by job satisfaction: sectors/industrial districts centre around high value added activities which require continuous skills updating, the presence of VET institutions catering to the skill needs of the sector/cluster will make it easier for firms to invest in training. If this training is integrated in highly developed human resources practices it will also increase job satisfaction levels, which in turn will have a positive impact on productivity levels and the competitiveness of the firms in the sector/cluster thus contributing to its success.

In this report there are examples of firms within a sector successfully clustering and networking, but examples too of where it has been less successful. It is crucial that employers across the sector/cluster are made aware of the potential returns so that collective action is maintained.

In Baden-Württemberg's medical technologies sector, Brainport's hi-tech cluster, the wind power engineering sector in Denmark, and the textiles sector in Flanders, there is a strong role given to either national or regional authorities in establishing both an R&D and training infrastructure. In training this goes much beyond initial education and training to provision of various institutions which are able to meet the demand for continuing VET. Such an approach is less in evidence in the financial service sector where the State's role is very much limited to the provision of initial VET. Arguably, this is because there is less evidence of a market failure for training with employers willing to compete on price in the global market for the skills they require. Also, some evidence suggest that the types of supply chain relationships found in the other regional clusters are less important to the major corporate players, i.e. the equivalent of OEM in the production sector.

The importance of the measures mentioned above is that they provide the means for sectors within the EU to protect themselves from global competition through providing a combination of mutually reinforcing investments in training and working conditions which are likely to provide competitive advantage with respect to value-added. In many instances the public sector will need to be the catalyst to bring about the successful implementation of policies which are likely to generate social benefits at sectoral level, i.e. a private return for employers plus a public return for society.

List of abbreviations

CVET	continuing vocational education and training
EWCS	European working conditions survey
HPWP	high performance work practice
OEM	original equipment manufacturers
R&D	research and development
R&D&D	research, development and demonstration
VET	vocational education and training

References

Aalborg University (2011a). *Master in wind energy: continuing education at Aalborg.* Available from Internet: http://www.windmaster.aau.dk/ [cited 19.12.2011].

Aalborg University (2011b). *Study programmes - wind power systems*. Available from Internet: http://studyguide.aau.dk/programmes/program/semester?id=39823&sid=54565 [cited 19.12.2011].

Adler, P.S. (1988). Managing flexible automation. *California management review*. Vol. 30, No 3, p. 34-56.

Agendschap Ondernemen (2011). *Agentschap Ondernemen website 2011* [online]. Available from: http://www.agentschapondernemen.be/english [cited 19.12.2011].

Akerloff, G.A. (1982). Labour contracts as partial gift exchange. *Quarterly journal of economics,* Vol. 97, p. 543-569.

Anker, I. et al. (2003). Measuring decent work with statistical indicators. *International labor review*, Vol. 142, No 2, p. 147-178.

Argyris, C. (1973). *On organisations of the future*. Beverly Hills, CA: Sage.

Baird, A; St-Amand, R. (1995a). *Trust within the organisation. Monograph issue 1*. Ottawa, Ontario: Public Service Commission of Canada.

Baird, A; St-Amand, R. (1995b). *Trust within the organisation, part 2: building trust. Monograph issue 2*. Ottawa, Ontario: Public Service Commission of Canada.

Battu, H. et al. (2004). Human capital spillovers in the workplace: evidence for the service sector in Britain. *International journal of manpower*, Vol. 25, No 1, p. 123-138.

Belgian Research (2007). *Multiple research in textile and polymer science and technology*. Ghent: University College Ghent, Faculty of applied engineering sciences. Available from Internet: http://english.hogent.be/english/assets/File/BelgianResearch2007-July07.pdf [cited 15.3.2012].

Blaug, M. (1968). The rate of return on investment in education. In: Blaug, M. (ed.) *Economics of education 1*. Harmondsworth: Penguin, Penguin modern readings, p. 215-259.

Blauner, R. (1964). *Alienation and freedom: the factory worker and his industry*. Chicago: University of Chicago Press.

Bosworth, D.L. (2004). *Organisational structure and design implications for enterprise performance: an overview of the literature*. Melbourne: University of Melbourne, MIAESR.

Bosworth, D.L. (2005). *Determinants of enterprise performance*. Manchester: University Press.

Bosworth, D.L.; Stanfield, C. (2009). *Review of employer collective measures: a conceptual review from a public policy perspective*. Wath-upon-Dearne: UKCES, UK Commission for Employment and Skills.

Bosworth, D.L. et al. (1994). A human capital approach to training. In: McNabb, R.; Whitfield, K. (eds) *The market for training*. Aldershot: Avebury, p. 58-106.

Bosworth, D.L. et al. (1996). *Economics of the labour market*. Harlow: Addison Wesley Longman.

Brainport Development (2010). *Brainport Eindhoven flyer*, Eindhoven: Brainport Development NV.

Brainport Development (2011). *Brainport 2020: top economy, smart society*. Eindhoven: Brainport Development NV.

Brainport Eindhoven (2006). *Brainport navigator 2013 beyond Lisbon*. Eindhoven: Brainport Eindhoven.

Brainport Foundation (2009): *Welcome to Brainport: working and living in one of Europe's top technology regions (third edition)*. Eindhoven: Brainport Development.

Brainport Foundation (2010). *Regional innovation indicators; evidence-based policy-making for Europe 2020 and for the European plan for research and innovation: the Brainport example*. Presentation by Drs T. van Lier. Eindhoven: Brainport Development.

Braverman, H. (1974). Labour and monopoly capital: the degradation of work in the twentieth century. *Monthly Review*, Vol. 26, No 3.

Brisbois, R. (2003). *How Canada stacks up: the quality of work: an international perspective.* Ottawa: CPRN, Canadian Policy Research Networks (Research paper; W23).

Brown, A. et al. (2004). Supporting learning in advanced supply systems in the automotive and aerospace industries. In: Rainbird, H. et al. (eds) *Workplace learning in context*. London: Routledge, p. 166-182.

BW Invest (2011). *Medizintechnik [Medical technology].* Baden-Württemberg. Available from Internet: http://www.bw-invest.de/eng/index_eng_392.aspx [cited 3.1.2012].

Cedefop (2010). *Skills for green jobs: European synthesis report*. Luxembourg: Publications Office of the European Union.

Cedefop (2011). *The anatomy of the wider benefits of VET in the workplace*. Luxembourg: Publications Office of the European Union (Research paper; 12).

Clarke, R.H. et al. (1980). *Workers' attitudes toward productivity: a new survey*. Washington, DC: US Chamber of Commerce.

Cooney, R.; Long, M. (2008). *Inter-firm cooperation in training*. Adelaide: NCVER, National Centre for Vocational Education Research.

Danish Government (2011). *Energy strategy 2050: from coal, oil and gas to green energy*. Copenhagen: Danish Ministry of Climate and Energy.

Danish wind industry association (2009). *Annual report 2008*. Frederiksberg: Danish wind industry association.

Danish wind industry association (2010). *Danish wind industry: annual statistics 2010*. Frederiksberg: Danish wind industry association.

Danish wind industry association (2011a). *Medlemmer [Members].* Frederiksberg: Danish wind industry association. Available from Internet: http://www.windpower.org/da/medlemmer/medlemmer.html [cited 19.12.2011].

Danish wind industry association (2011b). *Research and development*. Frederiksberg: Danish wind industry association. Available from Internet: http://www.windpower.org/en/policy/research_and_development.html [cited 19.12.2011].

Design academy Eindhoven (2010). *Jaarverslag 2009 [Annual report 2009]*. Eindhoven: Design academy Eindhoven.

Didato, S.V. (1976). How to overcome management's fear of training. *Training*, Vol. 13, No 5, p. 24-26.

DWPA (2011). *Technical training for the wind turbine industry*. Middelfart: DWPA, Danish wind power academy.

ELAt (2008). *Engineering the future: facts and figures.* ELAT, Eindhoven-Leuven-Aachen triangle. Eindhoven: Brainport-ELAt.

Eucomed (2007). *Medical technologies brief: Key facts and figures on the European medical technology industry*. Brussels: European Medical Technology Industry Association.

Eurofound (2002). *Quality of work and employment in Europe: issues and challenges.* Dublin: Eurofound, European Foundation for the Improvement of Living and working conditions.

European Commission (2003). Annex 1: Indicators of quality in work: list approved by the Council. In: European Commission. *Improving quality in work: a review of recent progress.* Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions. Luxembourg: Publication Office of the European Union, p. 23-27 (COM(2003) 728 final).

European Commission (2007). *Measuring progress towards a more sustainable Europe: 2007 monitoring report of the EU sustainable development strategy.* Luxembourg: Publications Office of the European Union (Eurostat Statistical books).

European Commission (2008). *Employment in Europe 2008.* Luxembourg: Publications Office of the European Union (Eurostat Statistical books).

European Commission (2009). Chapter 4: textiles, clothing, leather and footwear. In: *European business: facts and figures: 2009 edition*. Luxembourg: Publications Office of the European Union (Eurostat Statistical books).

European Commission (2010). *An agenda for new skills and jobs: a European contribution towards full employment.* Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Luxembourg: Publications Office of the European Union (COM(2010) 682 final).

European Parliament (2009). *Indicators of job quality in the European Union*. Brussels: European Parliament, Directorate General Internal Affairs.

Finegold, D. (1991). Institutional incentives and skill creation: preconditions for a high-skill equilibrium. In: Ryan, P. (ed.) *International comparisons of vocational education and training for intermediate skills.* London: Falmer.

Finegold, D. (1993). Breaking out of the low-skill equilibrium. *Education economics*, Vol. 1, No 1, p. 77-83.

Fedustria (2010). *Rapport annuel 2009-10 [Annual report 2009-10]*. Brussels: Fedustria.

Ghent University (2010). *Department of textiles: annual report 2009.* Ghent/Zijnaarde: Ghent University, Faculty of Engineering.

Griliches, Z. (1992). The search for R&D spillovers. *Scandinavian journal of economics*, Vol. 94, p. 29-47.

Hall, J. et al. (2010). *A framework to measure progress of societies.* Paris: OECD (Statistics working paper series; 34).

Hansen, J.D. et al. (2003). The establishment of the Danish windmill industry: was it worthwhile? *Review of world economics*, Vol. 139, Issue 2, p. 324-347.

Hogarth, T. (1992). Worker support for organisational and technical change: workplace industrial relations in UK manufacturing: the case study evidence. *Work, employment and society*, Vol. 7, p. 189-212.

Hogarth, T et al. (2009). *Review of employer collective measures: empirical review*. Wath-upon-Dearne: UKCES, UK Commission for Employment and Skills.

Hoque, K.; Bacon, N. (2008). Investors in people and training in the British SME sector. *Human relations*, Vol. 61, p. 451-482.

Huselid, M.A. (1995). The impact of human resource management practices on turnover, productivity, and corporate financial performance. *Academy of management journal*, Vol. 38, No 3, p. 635-672.

IER (2004). *Developing excellence in medical technologies: synthesis report*. Warwick: IER, Institute for Employment Research.

Industriens Uddannelser (2011) *Vindmølleoperatøruddannelsen (VOU): fordi kompetence skaber øget konkurrenceevne.* Copenhagen: Industriens Uddannelser.

Jagger, N. et al. (2005). *Sectors matter: an international study of sector skills and productivity.* Wath-upon-Dearne: Sector Skills Development Agency.

Kooperation international (2010). *Brainport region Eindhoven*, 28.5.2010. Berlin: Federal Ministry of Education and Research.

Landesinnung Chirurgiemechanik Baden-Württemberg (2011). *Meistervorbereitungskurs 'Chirurgiemechaniker' Teil I und II, Fachpraxis und Fachtheorie [Higher vocational training preparatory course 'surgery-mechanic craftsman' Part I and II, practice and theory]*. Tuttlingen: Landesinnung Chirugiemechanik Baden Württemberg.

Marshall, A. (1890). *Principles of economics*. London: Macmillan and Co.

Maslow, A. (1970). *Motivation and personality*. New York: Harper.

McGregor, D. (1967). *The professional manager*. New York: McGraw-Hill.

Morthorst, P.E. (1999). Capacity development and profitability of wind turbines. *Energy policy*, Vol. 27, p. 779-787.

Mußmann, F. (2009). *The German good-work index (DGB-Index Gute Arbeit)*. Paper presented at the ETUI Conference 2009, 18 and 19 March, Brussels.

MWK (2011a). *Förderung der wirtschaftsnahen Infrastruktur und Eigenkapitalbasis von Unternehmen, des Technologietransfers und der Clusterbildung [Funding of economic infrastructure and capital base of companies, of technology transfer and clustering]*. Stuttgart: Ministry of Science, Research and Arts.

MWK (2011b). *Förderung von FuE-Projekten an Fachhochschulen durch das Land Baden-Württemberg: Innovative Projekte/Kooperationsprojekte [Funding of R&D projects in universities via the state of Baden-Württemberg: innovative projects/cooperation projects]*. Stuttgart: Ministry of Science, Research and Arts.

OECD (2003). Chapter 5: upgrading workers' skills and competencies. In: *OECD economic outlook 2003: towards more and better jobs*. Paris: Organisation for Economic Cooperation and Development.

OECD (2007). *Globalisation and regional economies: can OECD regions compete in global industries?* Paris: OECD.

OECD (2009). *Employment Outlook*. Paris: OECD.

Pavitt, K. (1984). Sectoral patterns of technical change: towards a taxonomy and a theory. Research Policy, Vol. 13, No 6, December, p. 343-373.

Pfeffer, J. (1994). *Competitive advantage through people*. Boston: Harvard Business School Press.

Porter, M. (1990). *Competitive advantage of nations*. London: Macmillan.

Porter, M.; Ketels, C. (2003). *UK competitiveness: moving to the next stage*. London: DTI, Department of trade and Industry (DTI Economics paper No 3).

Prahalad, C.K. (1983). 'Developing strategic capability: an agenda for top management. *Human Resource Management*, Vol. 22, p. 237-254.

Rayton, B. (2007). *The causes and consequences of investors in people accreditation*. Claverton Down: Work and Employment Research centre.

Shafritz, J.M.; Ott, J.S. (eds) (1992). *Classics of organisational theory*. Belmont: Wadsworth. (3rd ed.).

Sørensen J.B. et al. (2010). *Energy 2010: research development demonstration*, July 2010.

Statistics Canada (2002). *Study of training and development line manager information related to promising practices and barriers to training*. Ottawa: Statistics Canada.

Stiglitz, J. et al. (2009). *Report by the Commission on the measurement of economic performance and social progress*. Available from Internet: www.stiglitz-sen-fitoussi.fr [cited 4.1.2012].

Tamkin, P. et al. (2008). *People and the bottom line*. Brighton: IES, Institute for Employment Studies (Report 448).

Temple, P. (2005). *The empirical economics of standards.* London: DTI, Department of trade and Industry (DTI Economics papers; No 12).

TU Eindhoven (2010). *Facts and figures: edition 2010*. Eindhoven: University of Technology.

TU Eindhoven (2011). *Where innovation starts: TU/e 2020 strategic plan*. Eindhoven: University of Technology.

Van Gijzel (2011). *Challenges and good practices in fighting the crisis: the viewpoint of EU cities and regions*. (Points for speech).

Vestergaard, J. et al. (2004). A brief history of the wind turbine industries in Denmark and the United States. In: *Academy of international business (Southeast USA Chapter) Conference proceedings*, November 2004, p. 322-327.

Vogler-Ludwig, K., Plesnila-Frank, C. (2003). *Medical technologies, benchmarking report for Germany*. Munich: Economix.

Vogler-Ludwig, K.; Valente, A.C. (2009). *Skills scenarios for the textiles, wearing apparel and leather products sector in the European Union*, *Final report*. Project on behalf of the European Commission, DG Employment, Social Affairs and Equal Opportunities.

Wirtschaftsministerium Baden-Württemberg (2011). Wirtschaftsministerium fördert Clusterinitiative MedicalMountains mit 405 000 Euro [Ministry of Economy promotes MedicalMountains cluster initiative with EUR 405 000]. Available from Internet: http://www.rp.baden-wuerttemberg.de/servlet/PB/menu/1324793/index.html [cited 15.3.2012].

WMRO (2006). *Regional skills assessment 2006*. Birmingham: West Midlands Regional Observatory.

Wolfe, B.L.; Zuvekas, S. (2000). Nonmarket outcomes of schooling. *International journal of educational research,* Vol. 27, p. 491-502.

Woodward, J. (1965). *Industrial organisation: theory and practice.* New York: Oxford University Press.

Wright, P.M. et al. (1994). Human resources and sustained competitive advantage: a resource-based perspective. *International journal of human resources management*, Vol. 5, p. 301-326.

Yellowmed (2011). *Wo kann ich Medizintechnik studieren [Where can I study medical engineering]*. Available from Internet: http://yellowmed.com/de/studium-medizintechnik/ [cited 4.1.2012].

Youndt, M.A. et al. (1996). Human resource management, manufacturing strategy, and firm performance. *Academy of management journal*, Vol. 39, p. 836-866.

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Training has a significant positive impact on workers' satisfaction with their jobs when it is integral to human resource policies. There is also a correlation between the effect of training on job satisfaction and on productivity growth. The way the wider benefits from training accrue to firms and workers are different, depending on various sector characteristics. In sectors with strong competition among firms, workers invest in training and the returns on this investment depend on their ability to elicit wage offers from various firms.
The returns on training can accrue in a cooperative environment in which social partnership is crucial. The role of the public sector is to bring about knowledge-sharing among firms, provide an infrastructure within which it can take place (including training provision), and so ensure a supply of skilled workers. This initial investment provides a natural cradle for the development of industrial clusters and is a pillar of any sectoral growth strategy.

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